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THE MICROCYCLIC SPECIES OF PUCCINIA ON SOLANUM [1]

FRANK D. KERN

(WITH PLATE 48)

Several years ago, while making a systematic study of the rusts of Colombia, some specimens of *Puccinia* of evident microcyclic life-history on the genus *Solanum* were encountered. Mayor in his excellent monograph, Contribution a l'etude des Uredinees de Colombia (Mem. Soc. Neuch. Sci. Nat. **5**: 442–599. 1913.), reported two species of this nature, *Puccinia huallagensis* P. Henn. and *P. solanicola* Mayor. According to Arthur in the North American Flora (**7**: 562. 1922.) a more or less similar species was reported on *Solanum* from Panama as *Puccinia solanita* (Schw.) Arth. (*Micropuccinia solanita* Arth. & Jackson). In a later number of the same work (**7**: 805. 1927.) Arthur reduced the name *M. solanita* to synonymy and substituted for it *Micropuccinia Solani* (Schw.) Arth. & Jackson founded on *Puccinia Solani* Schw. Whether these three really represented three valid species and if so how to distribute the Colombian specimens at hand became the problem.

While preparing the account ot the Uredinales for the Mycological Explorations of Colombia published by Chardon & Toro in 1930 (Jour. Dept. Agric. Puerto Rico **14**: 301–348) in conjunction with Whetzel some hasty decisions were made. No authentic specimens were available for comparison. In that paper

[1] Contribution from the Department of Botany, The Pennsylvania State College, no. 88. Publication authorized by the Director of the Pennsylvania Agricultural Exp. Station, April 18, 1933, Technical Paper no. 586.

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P. huallagensis was maintained as valid and it was decided that Mayor's *P. solanicola* was a synonym of *P. solanita.* Why the slightly older Schweinitzian name *P. Solani* was disregarded at that time inasmuch as Arthur's combination of it with *P. solanita* was then available I cannot now explain.

More recently we have been restudying the rusts of Colombia and the problem of the *Solanum* rusts has come up again. This time we have had available through the kindness of Dr. Mayor many of his original Colombian collections. In the meantime, 1932, there appeared a contribution to our knowledge of this group of South American rusts in the form of Jackson's sixth paper of the series, The Rusts of South America, based on the Holway Collections (Mycologia **24**: 62–186). The Holway specimens of *Solanum* rusts have also been available. Jackson recognized three previously described microcyclic species on the genus, *Puccinia imitans* from Ecuador, *P. Negeriana* from Argentina, *P. Solani-tristis* from Brazil, and described as new a fourth one, *P. aulica* Jackson & Holway, from Ecuador.

Taking into consideration other names in the literature, there were by this time the following names for consideration: *P. solanita* Schw., *P. Solani* Schw., *P. huallagensis* P. Henn., *P. solanicola* Mayor, *P. imitans* Sydow, *P. Solani-tristis* P. Henn., *P. Negeriana* Diet., *P. aulica* Jackson & Holw., *P. claviformis* Lagerh., *P. Hieronymi* P. Henn., *P. Pittieriana* P. Henn., *P. incondita,* and *P. Solanacearum* Sacc. & Sydow. All but the two last are South American. It seemed absolutely essential to have authentic specimens for comparison in order to determine the standing of these various names. The attempt to secure them was begun. Through the generous response of workers in several botanical centers at home and abroad, parts of the type specimens of all of these except *P. Pittieriana* and *P. Solanacearum* were assembled. For furnishing these specimens I am indebted to Messrs. J. C. Arthur, Purdue University; Don M. Benedict, The Academy of Natural Sciences of Philadelphia; G. Samuelsson, Naturhistoriska Riksmuseet, Stockholm; J. A. Stevenson, Bureau of Plant Industry, U. S. Department of Agriculture, Washington; N. E. Svedelius, University of Uppsala; and E. Ulbrich, Botanischer Garten und Botanisches Museum, Berlin. Through the

kindness of Dr. Arthur I have had available for examination all of the specimens of microcyclic species of *Puccinia* on Solanaceae in his herbarium.

The studies have resulted in the conclusion that there are nine species. A key has been arranged which will serve to separate them. Notes presenting synonymy, distribution, and other pertinent facts follow.

KEY TO MICROCYCLIC RUSTS ON SOLANUM

Sori evenly distributed over large areas.
Teliospores ellipsoid, not constricted, 19–24 × 24–34 μ. ....1. *P. Solani.*
Teliospores ellipsoid-clavate, constricted, 19–24 × 34–45 μ..2. *P. imitans.*
Sori definitely gregarious.
Teliospores chiefly 1-celled (mesospores), mostly 18–25 × 21–32 μ.
3. *P. Negeriana.*
Teliospores chiefly, or wholly, 2-celled.
Teliospores ellipsoid, not or slightly constricted.
Teliospores broadly ellipsoid, 18–25 × 26–35 μ.
Teliospores slightly constricted, pale golden-brown.
4. *P. Pittieriana.*
Teliospores usually not constricted, cinnamon-brown.
5. *P. aulica.*
Teliospores narrowly ellipsoid, 18–20 × 35–60 μ.
6. *P. Solanacearum.*
Teliospores clavate or ellipsoid-clavate, more or less constricted.
Teliospores 30–55 μ long.
Teliospore-wall thick, 2.5–3 μ, apex 5–9 μ. ...2. *P. imitans.*
Teliospore-wall medium-thick, 1.5–2 μ, apex 4–7 μ.
7. *P. claviformis.*
Teliospores 23–35 μ long.
Teliospore-wall thin, 1–1.5 μ, apex not or slightly thicker.
8. *P. Solani-tristis.*
Teliospore-wall medium, 1.5–2.5 μ, apex 3–6 μ.
9. *P. incondita.*

1. PUCCINIA SOLANI Schw.; Berk. & Curt. Jour. Acad. Phila. II. 2: 281. 1853

In the note accompanying the original latin description Schweinitz said "sori minute, distinct, compact, occupying the whole of the under surface, and only the midrib of the upper surface." The specimen at hand checks perfectly with this description. This diffuse distribution is quite distinct from the gregarious type of distribution. *P. imitans* is said to have this habit of sorus-distribution but the spores of the two are readily separable as

P. imitans has the spores constricted at the septum with the apex 5–9 μ as compared with no constriction and apices 4–6 μ in *P. Solani.*

Puccinia Solani was described from Surinam (Dutch Guiana) on *Solanum* sp. and it is known only from the type locality.

2. PUCCINIA IMITANS Sydow, Monog. Ured. **1**: 273. 1902

According to the original description, this species has both the diffuse and the gregarious types of distribution of the sori. It has therefore been entered twice in the key. In the specimen I have examined the sori are gregarious. The type locality is Quito, Ecuador, on *Solanum* sp. Holway collected it at the same place on *Solanum utile* in 1920 (See Jackson, Mycologia **24**: 82. 1932).

3. PUCCINIA NEGERIANA Diet. in Engl. Bot. Jahrb. **22**: 351. 1896. (May)

Puccinia Hieronymi P. Henn. Hedwigia **35**: 234. 1896. (Oct.)

P. Negeriana was described from Chile on *Solanum furcatum* and *P. Hieronymi* from Argentine on *S. incisum.* After studying and comparing the types of these I am inclined to put them together. I find no differences sufficient to maintain them as separate entities. The numerous mesospores characterize the species. The two names were published the same year but Dietel's publication has priority by a few months. Jackson has reported the species from Argentine on an undetermined *Solanum.*

4. PUCCINIA PITTIERIANA P. Henn. Hedwigia **43**: 147. 1904

Arthur has given a good account of the history of this rust in Science, N. S. **51**: 246–7. 1920. Up to that time it had been collected in Costa Rica, the type locality, in 1903 and 1904 by H. Pittier, and by Holway in 1916 on the wild potato, and in Ecuador in 1918 by A. Pachano on both potatoes and tomatoes. I have examined the specimen on the tomato and find that it agrees perfectly with those on the potato. Arthur also reports this rust from Peru, collected by Abbott in 1929 on *Solanum tuberosum* (Bull. No. 2 Est. Exper. Agric. Soc. Nac. Agraria, Lima). In

that report Arthur indicates the presence of urediniospores. In a recent letter Dr. Arthur writes that this is an error. The species is now known also from Colombia (Jour. Dept. Agric. Puerto Rico **14**: 331. 1930.) and from Venezuela where it was collected by Chardon (no. *1018*) in 1932. A discussion of the possible origin of the potato rust is given by Arthur in Science, N. S. **53**: 228–229. 1921.

5. PUCCINIA AULICA Jackson & Holw. Mycologia **24**: 82. 1932

This species has been described recently from Ecuador on *Solanum montanum*. No other collections are reported. The spores resemble those of *P. Solani* but are thinner-walled and darker in color. The two species are very different in habit.

6. PUCCINIA SOLANACEARUM Sacc. & Sydow, in Sacc. Syll. Fung. **14**: 358. 1899

Puccinia Solani Cooke, Grevillea **7**: 61. 1878. Not *P. Solani* Schw. 1853.

This was described from East India, Sutlej Valley, on *Solanum* sp. Of this I have not had an original specimen. The spores differ materially in shape and size from the South American forms that have been studied. In Saccardo, vol. 7, p. 718, the reference of a rust on *Chamaesaracha nana* from California to this species is an error. It belongs to *Puccinia Chamaesarachae* Sydow.

7. PUCCINIA CLAVIFORMIS Lagerh. Tromsö Mus. Aarsh **17**: 53. 1895

Aecidium solanitum Schw.; Berk. & Curt. Jour. Acad. Phila. II. **2**: 283. 1853 (hyponym).

Dicaeoma claviforme Kuntze, Rev. Gen. **3**[3]: 468. 1898.

Puccinia huallagensis P. Henn. Hedwigia **43**: 158. 1904.

Puccinia solanicola Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 505. 1913.

Puccinia solanita Arth. Mycologia **14**: 19. 1922.

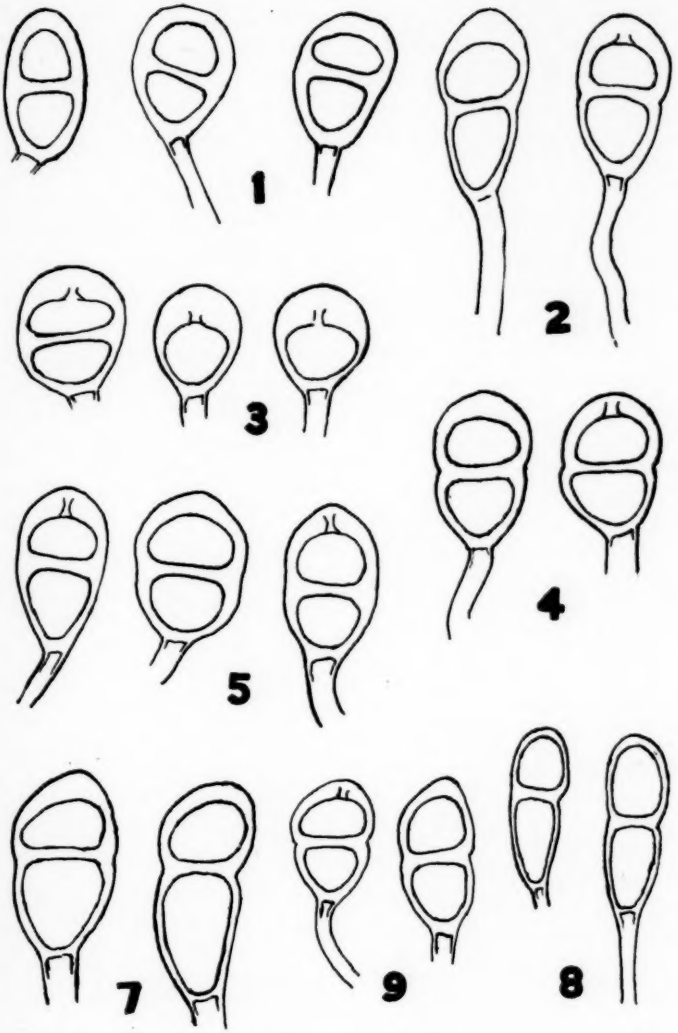
Micropuccinia solanita Arth. & Jackson, N. Am. Flora **7**: 562. 1922.

Judging from the number of collections, this is the most common species. The type locality is Surinam where it was collected on an undetermined species of *Solanum*. It has been collected in Colombia on *S. hirtum*, *S. straminifolium*, *S. torvum*, *S.* aff. *myrianthum*, *S.* aff. *ovalifolium*, and numerous times on undetermined species. I have examined fourteen collections from Colombia. Mayor reports at least half a dozen more collections which doubtless belong here but which I have not seen. I have examined a specimen collected in Trinidad by Seaver on *Solanum* sp. (See Mycologia **14**: 19. 1922). It is reported from Panama on *Solanum Donnell-Smithii* (N. Am. Flora **7**: 562. 1922.) and on *S. diversifolium* (N. Am. Flora **7**: 805). Lagerheim's name *Puccinia claviformis* was founded on the same specimen which Schweinitz had called *Aecidium solanitum*. The original publication of that name by Berkeley and Curtis stated that "the specimens are not in a sufficiently good state to enable us to draw up a specific character." On that account Lagerheim described the fungus as a new species. I am inclined to agree with him that the Schweinitz name *solanitum* never was adequately established. This makes the oldest name for the species *P. claviformis*. I am convinced that taking up the name *P. Solani* Schw. for this species and listing *P. Solani-tristis* P. Henn. as a synonym, as is done in the N. Am. Flora (**7**: 805), is an error since my investigations show that these are separate and distinct species.

Mayor found some spores with three or four cells as indicated by his illustration (Mem. Soc. Neuch. Sci. Nat. **5**: 506, *f. 34*). There is a specimen in the Arthur herbarium from Panama on *Solanum* sp. with a note that a fraction of one percent of the spores are of this sort. This condition must be rare as I have failed to note it in the numerous specimens examined. Arthur in the N. Am. Flora (**7**: 805) suggests that this "species is correlated with the heteroecious species, *Puccinia tubulosa* (Pat. & Gaill.) Arth., the telia being morphologically similar, and the hosts agreeing with the aecial hosts of the heteroecious species."

8. PUCCINIA SOLANI-TRISTIS P. Henn. Hedwigia **22**: 236. 1896

This species is characterized by the constricted thin-walled spores, not or only slightly thickened at the apex. This set of



PUCCINIA ON SOLANUM

spore characters is different from any of the other species. The type locality is Brazil, on *Solanum tristis*. Jackson (Mycologia **24**: 83. 1932.) reports it on *S. Neves-Armondii*, *S. rufescens*, and *Solanum* sp., all from Brazil. Altogether there are six Holway collections. The one on *S. rufescens* and one of the specimens on an undetermined *Solanum* are from the type locality, Therezopolis, Rio de Janeiro, Brazil.

9. PUCCINIA INCONDITA Arth. Bull. Torrey Club **45**: 148. 1918

A North American species described from Texas on *Solanum triquetrum*. Arthur suggests that it is similar in form to *Puccinia Pittieriana* but that it has slightly smaller spores. In general aspect the small spores resemble those of *Puccinia Solani-tristis* but they are broader, thicker-walled, and have more of a tendency to be thicker at the apex. It is known only from the type locality.

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EXPLANATION OF PLATE 48

1, *Puccinia Solani* Schw.; 2, *Puccinia imitans* Sydow; 3, *Puccinia Negeriana* Diet.; 4, *Puccinia Pittieriana* Arth.; 5, *Puccinia aulica* Jackson; 7, *Puccinia claviformis* Lagerh.; 8, *Puccinia Solani-tristis* P. Henn.; 9, *Puccinia incondita* Arth.

All of these, with the exception of *Puccinia Pittieriana*, were drawn from the type specimen. Magnification 1:625.

THE STANDING OF TWO SPECIES OF UROMYCES ON PANICUM[1]

H. W. Thurston, Jr.

(WITH TEXT FIGURES)

While engaged in a critical study of the rusts of Colombia together with F. D. Kern and H. H. Whetzel, a problem was encountered involving two species of *Uromyces* on *Panicum*. The solution of this problem so far as Colombian collections were concerned has thrown some light on certain misconceptions current in the rust literature of North America, so that a brief report of these studies seems desirable.

In studying the Mayor collections, a specimen no. *242*, said to be on *Panicum lanatum*, which Mayor had called *Uredo Henningsii*,[2] was found to bear both urediniospores and teliospores and thus was obviously not to be referred to the form genus *Uredo*. The teliospores were one-celled, but did not agree with the description of *U. leptodermus*, the only North American *Uromyces* reported on this host species. Sydow had recently described *Uromyces costaricensis* from Costa Rica on *Panicum altissimum* and the Mayor specimen seemed to fit this description. Through the kindness of Mr. G. Samuelsson, Director of the Botany Department, Naturhistoriska Riksmuseet, Stockholm, a part of the type of *U. leptodermus* was made available for comparison.

Fig. 1. *Uromyces leptodermus* (the type).

[1] Contribution from the Department of Botany, The Pennsylvania State College, no. 87. Publication authorized by the Director of the Pennsylvania Agricultural Experiment Station, April 18, 1933, as Technical Paper No. 587.

[2] Mem. Soc. Neuch. Sci. Nat. **5**: 578. 1913.

Doctor Sydow kindly sent a portion of the type of his *U. costaricensis*. These two specimens proved to be as different as their descriptions had led us to believe and the Mayor specimens checked up exactly with the type of *U. costaricensis*. Inasmuch as telia are rare on many tropical grass rusts, and the uredinia of both species in question are very similar, this led to the suspicion that perhaps *U. costaricensis* was really the more common form in the western hemisphere since *U. leptodermus* was originally described from East India. Therefore, as many specimens as possible were assembled for study. Doctor J. C. Arthur kindly supplied from his herbarium several specimens which proved valuable.

The two rusts proved to be practically indistinguishable in the uredinial stage, but easily separable in the telial stage. Teliospores were found on collections from Mona Island, Jamaica, Costa Rica, and Brazil, all labelled *U. leptodermus* which, however, agree much better with *U. costaricensis*. It is of additional interest to note that all of these were on host species belonging to a distinct section of *Panicum* known as *Lasiacis*, while *U. costaricensis* as described by Sydow was said to be on *Panicum altissimum*. Our specimen of the type of *U. costaricensis*, as well as the Mayor specimen, we referred to Dr. A. S. Hitchcock who thinks they are both *Lasiacis sorghoidea*. If this is true it means that all the specimens we have found bearing telia that are here referred to *U. costaricensis* are confined to the *Lasiacis* section of *Panicum* which is regarded by Hitchcock and others as a separate genus under the name *Lasiacis*. On the other hand, *U. leptodermus* was described on *P. javanicum* belonging to a very different section of a *Panicum*. We have found two collections, one from St. Croix and the other from Santo Domingo, which bear teliospores with the uniform wall thickness characteristic of *U. leptodermus*. Both of these are on *Panicum barbinode*, which is more or less related to *P. javanicum*, and quite unlike the *Lasiacis* species. It seems, therefore, that *U. leptodermus* does occur in the West Indies, but as suggested above, most of what has been passing as this species is better referred to *U. costaricensis* and further that the hosts can be used to distinguish these two rusts in the absence of teliospores.

There is another situation which complicates the matter as here presented. Four collections, two on *Panicum fasciculatum* from

Panama and Puerto Rico and two on *P. trichoides* from Venezuela and Puerto Rico, have 1-celled teliospores practically identical with those of *U. leptodermus* and in addition 2-celled spores of the ordinary *Puccinia*-type. These doubtless represent a species of *Puccinia* which is correlated with *Uromyces leptodermus* as indi-

FIG. 2. *Uromyces costaricensis* (the type).

cated by urediniospores, teliospores, and hosts. Whether the *Puccinia* species is properly called *P. Huberi* P. Henn. or *P. levis* Magn., or by one of the other *Puccinia* names which have been applied to *Panicum* rusts, is another question.

Following is a list of all collections at hand bearing telia of these two species of *Uromyces*.

UROMYCES LEPTODERMUS Sydow; Sydow & Butler, Ann. Myc. **4**: 430. 1906

On *Panicum javanicum* Poir. Dehra Dun. India, Sept. *22*, 1905. E. J. Butler *Type*.

Panicum barbinode Trin. Haina, Santo Domingo, March 11, 1926, Kern & Toro no. *45*; St. Croix, March, 1923, F. J. Seaver no. *880*.

UROMYCES COSTARICENSIS Sydow, Ann. Myc. **23**: 312. 1925

On *Lasiacis divaricata* (L.) Hitch. Mona Island, Dec. 20, 1913, F. L. Stevens no. *6145*; Santo Domingo, June 12, 1931, R. Ciferri no. *4171*; La Caja pr. San Jose, Costa Rica, Dec. 12, 1924, Sydow, Fungi exotici exsiccati no. *559*.

Lasiacis ligulata Hitch. & Chase. Rio Janeiro, Brazil, Sept. 16, 1921, E. W. D. Holway no. *1117*; Sept. 23, 1921, no. *1148*.

Lasiacis sorghoidea (Desv.) Hitch. & Chase (*Panicum altissimum* Meyer, *Lasiacis Schwartziana* Hitch.) Grecia, Costa Rica, Jan. 1, 1925, Sydow no. *178 Type*; Jamaica, Feb. 1891, R. Thaxter, no number; Andes Centrales, Dept. Antioquia, Eltoblado on dissus de Medellin, Colombia, Mayor no. *242*.

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PLASMOPARA HALSTEDII ON CINERARIA

D. L. Gill

A downy mildew of cineraria (*Senecio cruentus* DC.) was encountered during the autumn of 1932 by H. H. Whetzel. It was reported that about ten per cent of the plants in a greenhouse at Hempstead, Long Island, were affected, and the disease was causing a considerable loss. The plants were of the *multiflora* type, which is the common potted cineraria, the seed having been obtained from Germany. As a downy mildew had not been reported previously on this host, an investigation was undertaken under the direction of Professor H. M. Fitzpatrick.

The lesions appear on the under sides of the leaves as small white spots and on the upper sides as slightly browned areas. They are usually from 0.5 to 3 cm. in diameter although in some cases they include a larger area. The part of the leaf bearing these spots gradually dies, the color changing to a dark brown. The death of the remainder of the leaf soon follows.

Examination of the fungus showed that it belongs to the genus *Plasmopara*. It was compared with the description of *Plasmopara Halstedii* (Farl.) Berl. & De-Toni which is given by Wilson [1] as: "Hypophyllous, on cotyledons and leaves, the affected area small, 1–3 mm., or extending over the entire leaf; conidiophores fasciculate, slender, 300–750 μ, 3–5 times branched, ultimate branchlets 8–15 μ long, verticillate below the apex of the branching axis which is frequently swollen and ganglion-like; conidia oval or elliptic, 18–30 $\times$ 14–25 μ; oöspores 30–32 μ; epispore yellowish-brown, somewhat wrinkled."

The general characters of the fungus on cineraria fit this description. One hundred and one measurements were made of the sporangiophore and terminal branchlet lengths and 110 measurements of the spore size. The branches on the sporangiophores were counted. The number of branches and the terminal branch-

[1] Wilson, G. W. Studies in North American Peronosporales—II. Phytophthoreae and Rhysotheceae. Bull. Torrey Bot. Club **34**: 387–416. 1907.

let lengths compare well with the description. The figures for the sporangiophore length lie in the lower range and below the 300–750 μ given by Wilson. They were found to be 247–640 μ with a mean of 385.44 $\pm$ 8.23 and a standard deviation of 82.69. The spores are slightly below the range of spore size, being from 15–30 $\times$ 13–23 μ as compared with 18–30 $\times$ 14–25 μ. The measurements of the spore lengths have a mean of 19.67 $\pm$ .286 with a standard deviation of 1.74. The widths have a mean of 16.59 $\pm$ .199 and a standard deviation of 2.09. No oöspores were found in any of the material examined.

Specimens of *Plasmopara Halstedii* were examined on *Bidens frondosa* L. and *Rudbeckia hirta* L. These are clearly the same fungus.

It is not thought that the difference in sporangiophore length and spore size is sufficient to prevent the inclusion of the fungus on cineraria in this species, especially since Wilson says: "This is the most unsatisfactory species of a difficult genus. The conidiophores are very variable, especially in the laxity of their branches and the development of the ganglion-like swelling from which the ultimate branchlets arise. Several forms are clearly distinguishable and are apparently valid species, but further search has invariably brought to light intermediate forms connecting the extremes with the typical form and with other forms. Until an exhaustive study of a much greater quantity of material, both conidial and oösporic, is possible than is at present at hand, segregation of this species had best not be attempted."

Therefore, it is concluded that the fungus on *Senecio cruentus* DC. is *Plasmopara Halstedii* (Farl.) Berl. & De-Toni. A search of the literature has failed to reveal a record of *Plasmopara Halstedii* on this host. However, *Bremia Lactucae* Regel has been reported as occurring on cineraria in Europe.

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ANNOTATED INDEX OF THE RUSTS OF COLOMBIA [1]

F. D. Kern, H. W. Thurston, Jr., and H. H. Whetzel

In 1930 two of the present authors, Kern and Whetzel (**5**), contributed the account of the Uredinales to the Mycological Explorations of Colombia published by Chardon and Toro in the Journal of the Department of Agriculture of Puerto Rico, **14**: 301–348. Not excluding previous reports of rusts from this area by Léveillé (**7**), Earle (Dietel) (**2**), Prinzessin Therese von Bayern (**11**), Lindau (**8**), Sydow (**10**), and Kern and Chardon (**4**), the chief basis of information regarding Colombian rusts at that time was the careful and comprehensive monograph of Mayor in 1913 entitled Contribution à l'étude des Uredinees de Colombie (**9**).

As a result of subsequent studies, during which time many additional specimens have been available to us together with new information on tropical rusts in recently published papers, we have made many changes and additions to our presentation of 1930. A further explanation of why the present list differs so much from the one of 1930 seems in order. Changes may be due to the discovery of additional spore-forms, or they may be due to additional characters discoverable from the specimens but not from descriptions, or to mistaken identity of hosts, or to some combination of these or other new data.

The most important influence in the preparation of this revised list has been the availability of a large collection representative of the specimens on which the Mayor paper was founded. These were furnished in a fine spirit of coöperation by Dr. Mayor. Illustrative of the conceptions that become changed when specimens supplement descriptions, a few concrete cases are being cited in these prefatory remarks.

The case of *Uredo caucensis* Mayor is interesting. It was originally described as on *Vitis* sp. Although it did not agree too well,

[1] Contribution from the Department of Botany, The Pennsylvania State College, no. 89, and from the Department of Plant Pathology, Cornell University.

we jumped at a conclusion and referred it to the grape rust, *Phakopsora Vitis* in our 1930 paper. With the specimen at hand we discovered telial columns of the style of *Cronartium*. Close observation of the host indicated the need for re-examination. Soon some phanerogamic botanists pronounced it to be *Cissus rhombifolia*. It was then only a step to the identity of *Uredo caucensis* Mayor and *Crossopsora Wilsoniana* from the West Indies and Central America on the same host. *Uredo Salviarum* Mayor on *Salvia* had been placed by Arthur as a synonym of *Puccinia salviicola* Diet. & Holway. With only uredospore size, color, and wall characters available in the description, this reference seemed correct and we accepted it. With the additional information as to the peculiar pore characters, gained from an examination of the specimen, we were able to show its undoubted relation to *Puccinia Ballotaeflorae* Long. In the case of *Aecidium Gymnolomiae* Mayor discovery of uredinia and telia on the type specimen and the correction of an error in the original determination of his host enabled us to refer his species to *Puccinia Steiractiniae*. Comparison of *Uredo Caleae* Mayor with the uredo stage of *Puccinia Caleae* Arth., known from Mexico and Brazil, has given us an assurance of identity which we previously suspected but hesitated to assume. In addition to the determined specimens sent us by Dr. Mayor, he was kind enough to place in our hands a number of undetermined collections which proved to be helpful in adding to our information.

Five out of the six Baker specimens reported by Earle in 1899 have been available and examination has completely changed our conceptions of two of them. What was called *Uromyces Manihotis* P. Henn. is undoubtedly *U. Janiphae* (Wint.) Arth. and what was thought to be *Prospodium appendiculata* (Wint.) Arth. on some Bignoniaceae turns out to be *Prospodium Von Gunteni* (Mayor) Kern & Whetzel on *Lippia* sp.

Not only have our ideas changed with a study of additional specimens from the region concerned, but also with the study of other tropical rusts. Our continued investigations of the rusts of the West Indies, especially those of Santo Domingo, frequently have thrown light on relationships of forms in Colombia. We have also found most useful both the papers of Arthur (**1**) and

Jackson (**6**) on South American rusts and the Holway specimens, many of which we have had for examination.

We cannot overemphasize the value of checking up specific conceptions through the examination of type specimens. Without this procedure we could not have untangled the microcyclic rusts on *Solanum* or the *Uromyces* species on the grasses *Lasiacis* and *Panicum*. We have been very fortunate in being able to secure numerous type specimens which have enabled us to settle various problems which otherwise would have been difficult or impossible.

While additional rust names appear in the present list as a result of the straightening out process applied to old specimens, we have not been without new specimens not before available. In 1930 W. A. Archer collected in Colombia and through Mr. J. A. Stevenson, in charge of the mycological collections, Bureau of Plant Industry, U. S. Department of Agriculture, these have been placed at our disposal. These were largely determined by Mr. R. W. Davidson, then of that office, but in a residue undetermined by him we have found five new species.

Of the 215 species reported in this paper, 37 must still be assigned to the form-genera *Aecidium* and *Uredo*. The 178 whose life histories are known are distributed to 21 genera but in a very uneven manner since 102 belong to *Puccinia* and 32 to *Uromyces*. Eleven genera are represented in the list by one species each. Practically all of the information has been built up during the past twenty years. The large number of species referable only to *Aecidium* and *Uredo* emphasizes the incompleteness of our knowledge. Prior to Mayor's monograph eleven species were known from Colombia, Mayor reported 149, and our previous paper recognized 204. It should be borne in mind that these figures are not exactly comparable since specific conceptions are not identical in these reports but they give a rough idea of the accumulation of the knowledge of the rust flora of this region. It is interesting to note that of the large number of new species, 83, described in Mayor's monograph, 77.1 per cent are still regarded as valid. This serves to illustrate how little was known of the region at this time of his pioneer work.

To make the list an index to the fungi we have arranged the genera alphabetically and the species in like order under the genera.

In order to facilitate a ready means of ascertaining our conception of species we have included in their alphabetical sequence rust names, not accepted by us, which have been used in papers dealing with Colombian species. A complete index of the 331 hosts and a selected bibliography follows.

For responding promptly and generously to our special calls for assistance, particularly as regards the furnishing of much needed authentic or type specimens, acknowledgments are due to Messrs. J. C. Arthur, Purdue University; Don M. Benedict, The Academy of Natural Sciences of Philadelphia; H. S. Jackson, University of Toronto; G. Samuelsson, Natürhistoriska Riksmuseet, Stockholm; J. A. Stevenson, Bureau of Plant Industry, U. S. Department of Agriculture; N. E. Svedelius, University of Upsala; H. Sydow, Berlin; E. Ulbrich, Botanisher Garten und Botanishes Museum, Berlin; and William H. Weston, Jr., Harvard University.

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AECIDIUM (Form genus).

AECIDIUM ADENARIAE Mayor, Mem. Soc. Neuch. Nat. Sci. **5**: 556. 1913.

On *Adenaria floribunda* H.B.K., *Toro 305.*

Adenaria floribunda purpurata (H.B.K.) Koehne, *Mayor 175.*

AECIDIUM AMAGENSE Mayor. Error for *Synchytrium citrinum* (Sydow) Gäumann.

AECIDIUM (?) ARIDUM Diet. & Neg. Engl. Bot. Jahrb. **27**: 13. 1899.

On *Berberis rigidifolia* H.B.K., Paramo de Fontibon, Eastern Cordillera, dept. Santander del Norte, Sept. 16, 1932, *C. E. Chardon 759.*

This specimen has on it only a small amount of rust which is old and badly parasitized. The gross and microscopic characters agree with those given for *A. aridum* and we are referring our

specimen to this species but not without some doubt. There are several other species described from South America on the genus *Berberis*. *A. aridum* is known from Brazil and Chile.

AECIDIUM BOCCONIAE Mayor. See *Coleosporium Bocconiae* (Mayor) Sydow.

AECIDIUM BOGOTENSE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 563. 1913.

On *Geranium multiceps* Turcz., *Mayor 34*.

Not to be confused with an aecial stage associated with *Uredo unilateralis*. See note under that species.

AECIDIUM BOMAREAE Mayor. See *Puccinia Bomareae* P. Henn.

AECIDIUM BORRERIAE Pat. in Duss, Enum. Champ. Guadeloupe 7. 1903.

On *Hemidiodia ocimifolia* (Willd.) K. Schum., *Mayor 265*.

AECIDIUM CAPSICI Kern & Whetz. Jour. Dept. Agr. Puerto Rico **14**: 341. 1930.

On *Capsicum baccatum* L., *Toro 197; Chardon & Nolla 510*.

Davidson (Mycologia **24**: 226. 1932) suggests that this may be the aecial stage of *Puccinia paulensis* Rangel. The absence of both pycnia and telia in both collections of *A. Capsici* indicate a quite different life cycle.

AECIDIUM CISSI Wint. See *Endophyllum circumscriptum* (Schw.) Whetz. & Olive.

AECIDIUM CLIBADII Sydow. See *Endophyllum decoloratum* (Schw.) Whetz. & Olive.

AECIDIUM ERIGERONTIS Kern & Whetz. See *Puccinia Cyperi* Arth.

AECIDIUM GYMNOLOMIAE Mayor. See *Puccinia Steiractiniae*.

AECIDIUM HELIOPSIDIS Mayor. See *Puccinia Bimbergi* Mayor.

AECIDIUM LANTANAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 567. 1913.

On *Lantana hispida* H.B.K., *Mayor 213*.

We are following Jackson (Mycologia **24**: 63. 1932) in maintaining this as distinct from *Aecidium Verbenae* Speg. although

Arthur (N. Am. Flora **7**: 635. 1924) has combined the two. Jackson has reported this species from Brazil and Ecuador.

AECIDIUM LIABI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 576. 1913.

On *Liabum igniarum* (H. & B.) Less., *Mayor 197.*

Reported also from Mexico by Arthur (N. Am. Flora **7**: 643. 1924).

AECIDIUM MANETTIAE Kern & Whetz. Jour. Dept. Agr. Puerto Rico **14**: 343. 1930.

On *Manettia Toroi* Standley, *Toro 361.*

AECIDIUM MEDELLINENSE Mayor. Error for *Synchytrium* sp.

AECIDIUM PARAMENSE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 571. 1913.

On *Eupatorium obscurifolium* Hieron., *Mayor 43.*

AECIDIUM SPEGAZZINII De-Toni in Sacc. Syll. Fung. **7**: 802. 1888.

On *Erigeron bonariensis* L., *Mayor 19.*

The spores of this do not agree with those of *Puccinia Cyperi.* It may turn out to be *Puccinia Asterum.*

AECIDIUM STACHYTARPHETAE P. Henn. See *Endophyllum Stachytarphetae* (P. Henn.) Whetz. & Olive.

AECIDIUM VERNONIAE-MOLLIS Mayor. See *Coleosporium Vernoniae* Berk. & Curt.

AECIDIUM WEDELIAE Earle. See *Endophyllum decoloratum* (Schw.) Whetz. & Olive.

ALVEOLARIA Lagerh. Ber. Deuts. Bot. Ges. **9**: 346. 1891.

ALVEOLARIA CORDIAE Lagerh. Ber. Deuts. Bot. Ges. **9**: 346. 1891.

On *Cordia ferruginea* (Lam.) R. & S., *Chardon 562.*
Cordia laxiflora H.B.K., *Mayor 156.*

CEROTELIUM Arth. Bull. Torrey Club **33**: 30. 1906.

CEROTELIUM DESMIUM (Berk. & Br.) Arth. N. Am. Flora **7**: 698. 1925.

Uredo Gossypii Lagerh. Jour. Myc. **7**: 48. 1891.

On *Gossypium barbadense* L., *Toro 237; Chardon 170.*
Gossypium hirsutum L., *Chardon 590.*
Gossypium peruvianum Cav., *Chardon & Nolla 222; Chardon 15.*
Gossypium cf. *religiosum* L., *Mayor 200.*
Gossypium sp., *Mayor 63.*

CEROTELIUM FICI (Cast.) Arth. Bull. Torrey Club **44**: 509. 1917.

On *Ficus Carica* L., *Toro 278; Chardon & Nolla 247; Chardon 57, 378; L. Pardo Navarro 571.*

CHRYSOCELIS Lagerh. & Diet. Mem. Soc. Neuch. Sci. Nat. **5**: 542. 1913.

CHRYSOCELIS LUPINI Lagerh. & Diet. Mem. Soc. Neuch. Sci. Nat. **5**: 542. 1913.

On *Lupinus* sp., Mayor.

COLEOSPORIUM Lév. Ann. Sci. Nat. III. **8**: 373. 1847.

COLEOSPORIUM BOCCONIAE (Mayor) Sydow, Monog. Ured. **4**: 343. 1923.
Aecidium Bocconiae Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 560. 1913.

On *Bocconia frutescens* L., *Mayor 202b.*

COLEOSPORIUM DOMINGENSE (Berk.) Arth. Am. Jour. Bot. **5**: 329. 1918.
Coleosporium Plumierae Pat. Bull. Soc. Myc. Fr. **18**: 178. 1902.

On *Plumiera alba* L., *Chardon & Nolla 249.*
Plumiera rubra L., *Chardon & Nolla 404.*
Plumiera sp., *Chardon 13.*

COLEOSPORIUM ELEPHANTOPODIS (Schw.) Thüm. Myc. Univ. *953.* 1878.

On *Elephantopus mollis* H.B.K., *Chardon & Nolla 276, 574; Chardon 33, 715.*
Elephantopus scaber L., *Mayor 185a.*
Elephantopus spicatus (Juss.) Rohr., *Chardon & Nolla 315, 446.*
Elephantopus sp., *Baker 86* (specimen not seen).

COLEOSPORIUM EUPATORII Arth. Bull. Torrey Club **33**: 31. 1906.
On *Hebeclinium macrophyllum* (L.) DC. (*Eupatorium macrophyllum* L.), *Chardon 719; Mayor 74.*

COLEOSPORIUM FISCHERI Mayor. See *Coleosporium Ipomoeae* (Schw.) Burr.

COLEOSPORIUM IPOMOEAE (Schw.) Burr. Bull. Ill. Lab. Nat. Hist. **2**: 217. 1885.
Coleosporium Fischeri Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 550. 1913.
On *Ipomoea* aff. *caloneura* Meiss., *Mayor* (not seen).
Ipomoea sp., *Chardon 541; Mayor 287.*
Jacquemontia sp., *Toro 288.*
Quamoclit angulata (Lam.) Bojer, *Mayor 286a.*
Quamoclit coccinea (L.) Moench., *Chardon & Nolla 361.*

COLEOSPORIUM VERNONIAE Berk. & Curt. Grevillea **3**: 57. 1874.
Aecidium Vernoniae-mollis Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 570. 1913.
On *Vernonia* cf. *mollis* H.B.K., *Mayor 172d.*

Sydow (Monog. Ured. **4**: 307. 1924) has pointed out that the Mayor collection here cited is the aecial stage of a *Coleosporium* and not an *Aecidium*. Our examination of the specimen verifies this. The transfer of *Aecidium Vernoniae-mollis* to *Puccinia Vernoniae-mollis* (Jour. Dept. Agr. Puerto Rico **14**: 339. 1930) was an error.

CRONARTIUM Fries, Obs. Myc. **1**: 220. 1815.

CRONARTIUM PRAELONGUM Wint. Hedwigia **26**: 24. 1887.
On *Eupatorium conyzoides* Vahl., *Mayor 206a.*
Eupatorium inulifolium H.B.K., *Mayor 54.*
Eupatorium morifolium Miller, *H. H. Smith 669.*
Eupatorium odoratum L., *Chardon 643a, 686.*
Eupatorium pomaderrifolium Benth., *Mayor 55.*
Eupatorium popayanense Hieron., *Toro 296; Archer H–184.*
Eupatorium tacotanum Klatt., *Mayor 194; Chardon & Nolla 440.*
Eupatorium tequendamense Hieron., *Mayor 85.*

Eupatorium thyrsigerum Hieron., *Mayor 234.*
Eupatorium sp., *Mayor 159; Chardon 140.*

The specimens here listed as belonging to *Cronartium praelongum* show considerable variation as to diameter and length of the telial columns and as to size of the spores. The variations in measurements have been set forth both by Mayor (**9**, pp. 545–546) and in our earlier paper (Jour. Dept. Agr. Puerto Rico **14**: 305). We are in doubt as to the significance of such variations. *Cronartium andinum* Lagerh. seems without doubt to be a separate species. We have not seen authentic specimens of *C. eupatorinum* Speg. described from Argentine. This group needs further study. We are regarding *Cionothrix* as a microcyclic form of *Cronartium.*

CROSSOPSORA Sydow, Ann. Myc. **16**: 243. 1918.

Crossopsora caucensis (Mayor) comb. nov.
Uredo caucensis Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 587. 1913.
Cronartium Wilsonianum Arth. Mem. Torrey Club **17**: 114. 1918.
Crossopsora Wilsoniana Arth. N. Am. Flora **7**: 696. 1925.
On *Cissus rhombifolia* Vahl. (called *Vitis* sp. by Mayor), *Mayor 91.*

Through the kindness of Dr. Mayor we have had available the entire material of his collection no. *91.* A study of the host by Dr. H. A. Gleason and Mr. Percy Wilson of the New York Botanical Garden reveals that it is *Cissus rhombifolia.* We have found present telial columns which make certain the reference to the genus *Crossopsora.* Without seeing Mayor's specimen we erroneously referred *Uredo caucensis* to *Phakopsora Vitis* (Jour. Puerto Rico Dept. Agr. **14**: 304. 1930).

DICHEIRINIA Arth. N. Am. Flora **7**: 147. 1907.

DICHEIRINIA BINATA (Berk.) Arth. N. Am. Flora **7**: 147. 1907.
Uredo Cabreriana Kern & Kellerm. Jour. Myc. **13**: 25. 1907.
On *Erythrina glauca* Willd., *Toro 181; Chardon & Nolla 320; Mayor 321, 321a.*

ENDOPHYLLOIDES Whetz. & Olive, Am. Jour. Bot. **4**: 50. 1917.

ENDOPHYLLOIDES PORTORICENSIS Whetz. & Olive, Am. Jour. Bot. **4**: 50. 1917.

On *Mikania Guaco* H. & B., *Chardon 575.*

ENDOPHYLLUM Lév. Mem. Soc. Linn. Paris **4**: 208. 1825.

ENDOPHYLLUM CIRCUMSCRIPTUM (Schw.) Whetz. & Olive, Am. Jour. Bot. **4**: 49. 1917.

Aecidium circumscriptum Schw.; Berk. & Curt. Jour. Phila. Acad. Sci. II. **2**: 283. 1853.

Aecidium Cissi Wint. Hedwigia **23**: 168. 1884.

Endophyllum guttatum Sydow, Ann. Myc. **18**: 179. 1920.

On *Cissus sicyoides* L. (*Vitis sicyoides* (L.) Baker), *Toro 206, 268; Chardon & Nolla 275; Mayor 305b.*

Cissus sp. (*Vitis* sp.), *Mayor 45* (not seen).

Sydow has pointed out (Mycologia **18**: 179. 1920) that *Aecidium guttatum* Kuntze (1827) was doubtless applied to this species but the name seems not to have established without doubt by Kuntze in Weigelt's Exsiccati.

ENDOPHYLLUM DECOLORATUM (Schw.) Whetz. & Olive, Am. Jour. Bot. **4**: 49. 1917.

Aecidium Wedeliae Earle, Muhlenbergia **1**: 16. 1901.

Aecidium Clibadii Sydow, Ann. Myc. **1**: 333. 1903.

On *Clibadium surinamense* L., *Toro 200, 241; Chardon & Nolla 532, 701; Mayor 106; Archer H–171.*

Clibadium surinamense asperum (Aublet) Baker, *Mayor 299a.*

Wedelia carnosa Rich., *Mayor 135.*

We have in addition one other collection, *Chardon 717*, previously undetermined as to host or rust, which is without doubt this species on *Clibadium*.

ENDOPHYLLUM STACHYTARPHETAE (P. Henn.) Whetz. & Olive, Am. Jour. Bot. **4**: 50. 1917.

Aecidium Stachytarphetae P. Henn. Hedwigia Beibl. **38**: 71. 1899.

On *Valerianodes cayennense* (L. C. Rich.) Kuntze, (*Stachytarpheta cayennensis* (Rich.) Vahl.), *Chardon 560; Toro 228, 554; Mayor 177a.*

KUEHNEOLA Magn. Bot. Centr. **74**: 169. 1898.

KUEHNEOLA LOESENERIANA (P. Henn.) Jackson & Hol. Mycologia **23**: 105. 1931.

Uredo Loeseneriana P. Henn. Hedwigia **37**: 373. 1898.

Spirechina Loeseneriana Arth. Jour. Myc. **13**: 30. 1907.

Uromyces Loesenerianus Sydow, Monog. Ured. **2**: 202. 1910.

On *Rubus urticifolius* Poir. *Mayor 107; Toro 323; Archer H–16.*

According to Jackson (Mycologia **23**: 105. 1931) the teliospores of this species occur in chains which means that it belongs to the genus *Kuehneola.* Since this species (*Uredo Loeseneriana*) was the type of the genus *Spirechina* that name now becomes a synonym of *Kuehneola.* The several species with teliospores borne singly previously referred to *Spirechina* are now included under *Mainsia.*

MAINSIA Jackson, Mycologia **23**: 106. 1931.

This name was proposed by Jackson to replace *Spirechina* when it was found that the type species of the latter belonged to *Kuehneola.* An important difference between the two genera is that *Mainsia* has teliospores borne singly on pedicels whereas *Kuehneola* has them in chains.

Mainsia columbiensis (Kern & Whetz.) comb. nov.

Spirechina columbiensis Kern & Whetz. Jour. Dept. Agr. Puerto Rico **14**: 308. 1930.

On *Rubus* sp., *Toro 266.*

MAINSIA CUNDINAMARCENSIS (Mayor) Jackson, Mycologia **23**: 114. 1931.

Spirechina cundinamarcensis Diet. in E. & P. Nat. Pfl. 2nd ed. **6**: 60. 1928.

Uromyces cundinamarcensis Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 452. 1913.

On *Rubus peruvianus* Fritsch, *Mayor 105.*

MAINSIA LAGERHEIMII (P. Magn.) Jackson & Holw. Mycologia **23**: 110. 1931.

Spirechina Lagerheimii Kern & Whetz. Jour. Dept. Agric. Puerto Rico **14**: 309. 1930.

Uromyces Lagerheimii P. Magn. Ber. Deuts. Bot. Ges. **14**: 377. 1896.

On *Rubus glaucus* Benth., *Mayor 101.*
Rubus sp., *Mayor 302* (not seen).

MAINSIA MAYORII Jackson, Mycologia **23**: 112. 1931.
Spirechina quitensis Kern & Whetz. Jour. Dept. Agric. Puerto Rico **14**: 309. 1930.
Uromyces quitensis Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 456. 1913. Not Lagerheim 1895.
On *Rubus* sp., *Mayor 105a, 322a; Toro 570.*

Jackson has provided a name for this species which he says was referred by Mayor to *Uromyces quitensis* Lagerh. in error. For further explanation see Mycologia **23**: 112, 113, 115. 1931. Both of the Mayor specimens examined by us, and the Toro specimen, have only uredinia present. Both sori and spores agree perfectly with Mayor's account. We find the walls of the uredospores to be thicker than indicated in Jackson's paper.

MAINSIA RUBI-URTICIFOLIII (Mayor) Jackson, Mycologia **23**: 115. 1931.
Spirechina Rubi-urticifolii Kern & Whetz. Jour. Dept. Agric. Puerto Rico **14**: 309. 1930.
Uromyces Rubi-urticifolii Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 454. 1913.
On *Rubus adenotrichos* Schlecht. Tranvia de Oriente, *22* Km. north of Medellin, Feb. *7*, 1931, *Archer H–233.*
Rubus urticifolius Poir., *Mayor 300.*
Rubus sp., *Toro 270.*
Apparently a microcyclic species.

MAINSIA VARIABILIS (Mayor) Jackson & Holw. Mycologia **23**: 111. 1931.
Spirechina variabilis Diet. in E. & P. Nat. Pfl. 2nd ed. **6**: 60. 1928.
Uromyces variabilis Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 457. 1913.
On *Rubus* sp., *Chardon & Nolla 610; Mayor 301* (not seen).

MILESINA BLECHNI Sydow. See *Milesia australis* Arth.

MILESINA DENNSTAEDTIAE Mayor. See *Milesia Dennstaedtiae* (Mayor) Faull.

MILESINA COLUMBIENSIS Diet. See *Milesia columbiensis* (Diet.) Arth.

MILESIA F. B. White, in Scot. Nat. **4**: 162. 1877.

MILESIA AUSTRALIS Arth. Bull. Torrey Club **51**: 53. 1924.
On *Blechnum occidentale* L., *Mayor 182c.*

In the Mayor paper (Mem. Soc. Neuch. Sci. Nat. **5**: 559) Dietel referred this rust on *Blechnum* to *Milesina Blechni* Sydow. Faull in his recent monograph (Contr. Arnold Arboretum of Harvard University II, 41. 1932) refers this Colombian species to *Milesia australis*, and makes the Mayor collection *no. 182c* the type of *Milesia australis* forma *irregularis* Faull.

MILESIA COLUMBIENSIS (Diet.) Arth. Mycologia **7**: 175. 1915.
Milesina columbiensis Diet.; Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 559. 1913.
On *Nephrolepis pendula* Raddi., *Mayor 151* (not seen).

For revised description of this species see Faull (Contr. Arnold Arboretum Harvard University II, 75. 1932).

MILESIA DENNSTAEDTIAE (Diet.) Toro, Rev. Soc. Colomb. Ci. Nat. **18**: 43. 1929.
Milesina Dennstaedtiae Diet.; Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 558. 1913.
On *Dennstaedtia rubiginosa* (Kaulf.) Moore, *Mayor 184.*

PHAKOPSORA Diet. Ber. Deuts. Bot. Ges. **13**: 334. 1895.

PHAKOPSORA (?) AESCHYNOMENIS Arth. Bull. Torrey Club **44**: 509. 1917.
Uredo Aeschynomenis Arth. Bot. Gaz. **39**: 392. 1905.
On *Aeschynomene americana* L., *Mayor 153a.*
Aeschynomene sensitiva Sw., *Mayor 153.*

The telia of this species are yet unknown and it is not possible to refer it to the proper genus without doubt. We are following Arthur in referring it to the genus *Phakopsora.*

PHAKOPSORA COLUMBIANA Kern & Whetz. Jour. Dept. Agric. Puerto Rico **14**: 304. 1930.
On *Croton gossypifolius* Vahl., *Chardon 552b, 555.*

Several authors have recognized the genus *Bubakia* which differs from *Phakopsora* in having neither peridium nor paraphyses in the uredinia. If *Bubakia* were to be maintained this species along with several others on the host *Croton* would be referred to that genus.

PHAKOPSORA VIGNAE (Bres.) Arth. Bull. Torrey Club **44**: 509. 1917.

Uredo Teramni Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 587. 1913.

Uredo concors Arth. Mycologia **7**: 330. 1915.

On *Teramnus uncinatus* (L.) Sw., *Mayor 274.*

The characters given by Mayor in the original description of *Uredo Teramni* did not indicate its relation to the North American rust on this host (*Uredo concors* Arth.) and such a probability was rejected by Arthur (Mycologia **7**: 331. 1915) and again by us (Jour. Dept. Agr. Puerto Rico **14**: 346. 1930). Examination of the type specimen, however, clearly proves its identity. The type has the characteristic sorus opening by a central pore and the typical paraphyses are present. Arthur has assigned this uredo-form to the genus *Phakopsora* but the absence of telia on all specimens does not admit such a reference without some doubt.

PHAKOPSORA VITIS (Thüm.) Sydow, Hedwigia **38**: 141. 1899.

On *Vitis* sp., *Chardon & Nolla 479.*

For *Uredo caucensis* Mayor, which was included here as a synonym (Jour. Dept. Agri. Puerto Rico **14**: 304. 1930) see *Crossopsora caucensis.*

PHRAGMIDIUM Link, Ges. Nat. Freunde Berlin Mag. **7**: 30. 1815.

PHRAGMIDIUM DISCIFLORUM (Tode) James, Contr. U. S. Nat. Herb. **3**: 276. 1895.

On *Rosa* sp. (cultivated), *Toro 413; Mayor 7* (not seen).

PROSPODIUM Arth. Jour. Myc. **13**: 31. 1907.

PROSPODIUM APPENDICULATUM (Wint.) Arth. See *Prospodium Von Gunteni* (Mayor) Kern & Whetz.

PROSPODIUM VON GUNTENI (Mayor) Kern & Whetz. Jour. Dept. Agric. Puerto Rico **14**: 310. 1930.

Puccinia Von Gunteni Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 490. 1913.

On *Lippia americana* L., *Mayor 368.*
Lippia sp., *Baker 93.*

Through the kindness of Dr. Samuelsson, of Stockholm, we have had a part of the Baker collection for study. Dietel (Bull. Torrey Club **26**: 632. 1899) studied this specimen. He thought it was on some Bignoniaceae and remarked that although the appendages on the teliospore pedicels were poorly developed or wanting he did not doubt its determination as *Puccinia appendiculata.* A note on the original says " on a shrubby herb—one of the Myrsinaceae? " Our examination of the rust shows that the teliospores have one whorl of appendages and that both teliospores and uredospores agree with *Prospodium Von Gunteni.* A detailed study of the fragmentary specimen also shows that the veining, margin, and pubescence of the leaf are so nearly identical with those of Mayor's no. *368* that there seems no doubt about the possibility of its being a species of *Lippia.*

PUCCINIA Link, in Willd. Sp. Pl. **6**^{2}: 67. 1825.

PUCCINIA ABREPTA Kern, Mycologia **11**: 140. 1919.
On *Cyperus* sp., *Chardon 115, 707.*

PUCCINIA ALBIDA Diet. & Meg. See *Puccinia pallidissima* Speg.

PUCCINIA ANCIZARI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 525. 1913.

On *Baccharis nitida* Pers., *Mayor 65, 170a.*

The number *170a* was used also under *Puccinia Mayerhansi,* p. 521, by Mayor.

PUCCINIA ANODAE Sydow, Monog. Ured. **1**: 475. 1903.
On *Anoda cristata* (L.) Schlecht., *Killip* (phan. spec.) no. *6200.*
Anoda hastata Cav., *Mayor 90, 218.*

A microcyclic species. Mayor's no. *90* listed by him as *Puccinia heterospora* belongs here.

PUCCINIA ANTIOQUIENSIS Mayor. See *Puccinia subcoronata* P. Henn.

PUCCINIA APPENDICULATA Wint. See *Prospodium Von Gunteni* (Mayor) Kern & Whetz.

PUCCINIA ARECHAVELATAE Speg. Anal. Soc. Ci. Argent. **12**: 67. 1881.

On *Cardiospermum* sp., *Toro 552.*
Serjania (?) *brevipes* Benth., *Chardon & Nolla 428.*
Serjania membranacea Splitg., *Chardon & Nolla 423.*
Serjania sp., *Mayor 318.*
Sapindaceae sp., *Mayor 317, 319, 320.*

A microcyclic species.

PUCCINIA ASTERIS Duby, Bot. Gall. **2**: 888. 1830.
Puccinia Doloris Speg. Anal. Soc. Ci. Argent. **12**: 23. 1881.
On *Erigeron* cf. *uliginosus* Benth., *Mayor 229.*

PUCCINIA ATRA Diet. & Holw. Bot. Gaz. **24**: 29. 1897.
On *Paspalum prostratum* Scrib. & Merr., *Chardon 663, 665.*

PUCCINIA BACCHARIDIS-RHEXIOIDES Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 517. 1913.
On *Baccharis rhexioides* H.B.K., *Chardon & Nolla 273; Chardon 546; Mayor 199.*

PUCCINIA BALLOTAEFLORAE Long, Bull. Torrey Club **29**: 116. 1902.
Uredo Salviarum Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 592. 1913.
On *Salvia cataractarum* Briq., *Mayor 49.*
Salvia Mayorii Briq., *Mayor 47.*
Salvia petiolaris H.B.K., *Mayor 203.*

Arthur (N. Am. Flora **7**: 411. 1921) placed *Uredo Salviarum* Mayor as a synonym of *Puccinia salviicola* Diet. & Holw. On the basis of Mayor's description, this seemed correct and was followed in our paper on Colombian rusts (Jour. Dept. Agric. Puerto Rico **14**: 334. 1930). Examination of Mayor's specimens here listed convinces us that this is an error. We find these specimens to have 3–4 pores, 2 slightly below the equator, and 1 or 2 apical. This is a peculiar arrangement and agrees with Long's *P. Ballotaeflorae*. With only uredospore size, color, and wall characters it

would be impossible to separate *P. salviicola* and *P. Ballotaeflorae*. The pore characters would seem to leave no doubt.

PUCCINIA BARRANQUILLAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 533. 1913.

On *Spilanthes urens* Jacq., *Mayor 127*.

A microcyclic form closely related to *Puccinia Melampodii*.

PUCCINIA BECKI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 509. 1913.

On *Vernonia Cotoneaster* (Willd.) Less., *Mayor 32*.

PUCCINIA BIMBERGI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 530. 1913.

Aecidium Heliopsidis Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 573. 1913.

On *Heliopsis buphthalmoides* (Jacq.) Dunal, *Toro 289, 320; Chardon 713; Mayor 239, 239a.*

Mayor has already pointed out the possible relation of these two forms. One of the Toro collections, no. *320,* bears both aecia and telia in such a manner as to suggest relationship. Further evidence comes from the North American species, *Puccinia Batesiana* Arth. on *Heliopsis,* which has a life cycle with aecia and telia without a uredo stage. The South American form resembles *P. Batesiana* in most respects but for the present it seems best to consider the two as parallel and closely related species.

PUCCINIA BOCCONIAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 478. 1913.

On *Bocconia frutescens* L., *Mayor 202*.

A microcyclic species.

PUCCINIA BOGOTENSIS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 480. 1913.

On *Geranium multiceps* Turcz., *Mayor 364* (not seen).

A microcyclic species with large teliospores (18–24 × 65–87 μ).

PUCCINIA BOMAREAE (Lagerh.) P. Henn. Hedwigia **35**: 342. 1896.

Uredo Bomareae Lagerh. in Pat. & Lagerh. Bull. Soc. Myc. Fr. **11**: 215. 1895.

Aecidium Bomareae Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 559. 1913.

On *Bomarea* cf. *Caldasii* (H.B.K.) Willd., *Mayor 13.*
Bomarea potacocensis Herb., *Mayor 14* (specimen not seen).

Examination of Mayor's specimen no. *13* convinces us that it is a *Uredo* rather than an *Aecidium*. The spore characters agree sufficiently well to warrant the disposition here made. The species is known also from Ecuador and Brazil.

PUCCINIA BOMBACIS Diet.; Earle, Bull. Torrey Club **26**: 632. 1899.

On *Bombax* sp., *Baker 80.*

Through the kindness of Mr. G. Samuelsson, Director of the Botany Department, Naturhistoriska Riksmuseet, Stockholm, we have been able to examine the type specimen.

PUCCINIA CAEOMATIFORMIS Lagerh.; Sydow, Monog. Ured. **1**: 24. 1902.

On *Baccharis floribunda* H.B.K., *Chardon 599, 644.*
Baccharis polyantha H.B.K., *Mayor 99.*

PUCCINIA CALEAE Arth. Bot. Gaz. **40**: 201. 1905.
Uredo Caleae Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 598. 1913.

On *Calea glomerata* Klatt., *Mayor 195.*

Examination of specimens from Mexico and Brazil referred to *Puccinia Caleae* Arth. convince us that there is no difference between the uredo stage of that species and *Uredo Caleae* Mayor.

PUCCINIA CAMELIAE (Mayor) Arth. Mycologia **7**: 227. 1915.
Uredo Cameliae Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 578. 1913.

On *Chaetochloa scandens* (Schrad.) Scribn. & Merr. (*Setaria scandens* Schrad.), *Mayor 257.*

PUCCINIA CANALICULATA (Schw.) Lagerh. Tromsö Mus. Aarsh. **17**: 51. 1894.

On *Cyperus ferax* L. C. Rich., *Chardon & Nolla 220.*

PUCCINIA CANNAE (Wint.) P. Henn. Hedwigia **41**: 105. 1902.

On *Canna coccinea* Miller., *Mayor 196a.*
Canna sp., *Chardon 712.*

PUCCINIA CAPSICI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 501. 1913.

On *Capsicum* cf. *baccatum* L., *Mayor 84.*

A microcyclic form.

PUCCINIA CENCHRI Diet. & Holw.; Holw. Bot. Gaz. **24**: 28. 1897.

On *Cenchrus echinatus* L., *Chardon & Nolla 430; Chardon 169; Mayor 154.*

Pennisetum bambusiforme (Tourn.) Hemsl., *Toro 276.*

PUCCINIA CHAETOCHLOAE Arth. Bull. Torrey Club **34**: 585. 1907.

On *Paspalum macrophyllum* H.B.K., *Chardon & Nolla 287.*

PUCCINIA CHASEANUM Arth. & Fromme, Torreya **15**: 264. 1915.

On *Anthephora hermaphrodita* (L.) Kuntze, Virginias, Jan. 12, 1931, *Archer H–207.*

Both uredinia and telia are present. The spores agree very well with the description of *Puccinia Chascanum.* Paraphyses are present and are inclined to be somewhat capitate rather than hyphoid as described but this does not seem to us an important variation. We do not find that this species has been reported previously from South America; it is known from the West Indies and Central America.

PUCCINIA CLAVIFORMIS Lagerh. Tromsö Mus. Aarch. **17**: 53. 1895.

Puccinia huallagensis P. Henn. Hedwigia **43**: 158. 1904.

Puccinia solanicola Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 505. 1913.

Puccinia solanita Arth. Mycologia **14**: 19. 1922.

On *Solanum hirtum* Vahl., *Mayor 3.*

Solanum aff. *myrianthum* Britt., *Toro 403.*

Solanum aff. *ovalifolium* H. & B., *Mayor 46.*

Solanum stramonifolium Jacq., *Toro 183.*

Solanum torvum Sw., *Chardon 570; Chardon & Nolla 274; Archer H–12; Toro 187.*

Solanum aff. *torvum* Sw., *Mayor 190.*

Solanum sp., *Chardon 10; Chardon & Nolla 339, 357; Baker 76; Mayor 98.*

Our investigations of the microcyclic rusts on *Solanum* convince us that the name *Puccinia solanita* as used in our former paper (Jour. Dept. Agric. Puerto Rico **14**: 335) is not a tenable name having been founded on *Aecidium solanitum* Schw. which was a hyponym. Lagerheim proposed *P. claviformis* for this species and it seems to be the acceptable name. *P. Solani* Schw. taken up by Arthur (N. Am. Flora **7**: 805. 1927) for this species is a different thing. We believe *P. solanicola* Mayor is a synonym of *P. claviformis*. We are referring all the collections determined by Mayor as *P. huallagensis* to *P. claviformis*. For discussion of this and related microcyclic forms on *Solanum* see Kern (Mycologia **25**: 435–441. 1933).

PUCCINIA CLEMATIDIS (DC.) Lagerh. Tromsö Mus. Aarsh. **17**: 54. 1895.

On *Bromus unioloides* H.B.K., *Chardon 647.*

Triticum aestivum L., *Chardon & Nolla 445; Archer H–67, H–229; Chardon 760.*

PUCCINIA CONOCLINII Seym.; Burrill, Bot. Gaz. **9**: 191. 1884.
Uredo Agerati Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 595. 1913.

On *Ageratum conyzoides* L., *Chardon 714; Mayor 217; Archer H–62, H–144.*

Ageratum conyzoides L. var. *inaequipaleaceum* Hieron., *Mayor 53.*

The collections on *Eupatorium* which were included under this species (Jour. Dept. Agric. Puerto Rico **14**: 321. 1930) are now listed under *Uredo Eupatoriorum* Mayor.

(?) PUCCINIA CONTURBATA Jackson & Holw. Mycologia **24**: 75. 1932.

On *Salvia palaefolia* H.B.K., LaSierra, 18 km. north of Medellin, Dec. 26, 1930, II, *Archer H–186.*

With the numerous rusts on *Salvia* it is difficult, if not impossible, to be certain of a determination when only uredinia are present. This specimen fits the description of *Puccinia conturbata* but we do not feel it can be so referred without doubt.

PUCCINIA CONVOLVULACEARUM Mayor. See *Puccinia Spegazzinii* De-Toni.

PUCCINIA CRASSIPES Berk. & Curt., Grevillea **3**: 54. 1874.
Puccinia Ipomoeae-panduratae Sydow, Monog. Ured. **1**: 323. 1902.
On *Ipomoea* aff. *caloneura* Meiss., *Mayor 289.*
Ipomoea sp., *Toro 405; Chardon 121; Mayor 287b.*

PUCCINIA CUNDINAMARCENSIS Mayor. See *Puccinia ferox* Diet. & Holw.

PUCCINIA CYNODONTIS Lacroix, in Desmaz. Pl. Crypt. II. 655. 1859.
On *Capriola Dactylon* (L.) Kuntze, *Toro 184; Archer H–124.*

PUCCINIA CYPERI Arth. Bot. Gaz. **16**: 226. 1891.
Aecidium Erigerontis Kern & Whetz. Jour. Dept. Agr. Puerto Rico **14**: 342. 1930.
On *Erigeron bonariensis* (L.) Small, *Chardon & Nolla 424.*
Cyperus caracasanus Kunth, *Chardon & Nolla 312.*
Cyperus globulosus Aubl., *Chardon & Nolla 230.*

Dr. J. J. Davis, in Wisconsin, has proved by cultures that *Puccinia Cyperi* develops its acial stage on *Erigeron* (Trans. Wis. Acad. Sci. **27**: 187. 1932). He states that the aeciospores on *Erigeron* have walls thicker above. We believe that *Aecidium Erigerontis* described by us from Colombia is identical with the form connected by Dr. Davis to *Puccinia Cyperi.* These aeciospores differ from those belonging to *Puccinia Asterum,* also on *Erigeron,* in their larger size as well as in the thickening in the upper part of the wall. Without doubt many specimens in herbaria on *Erigeron* labelled as *Puccinia Asterum* will be found to belong to *Puccinia Cyperi.*

PUCCINIA DICHROMENAE (Arth.) Jackson, Trans. Brit. Myc. Soc. **13**: 16. 1928.
Uredo Dichromenae Arth. Bull. Torrey Club **33**: 31. 1906.
On *Dichromena ciliata* Vahl., *Chardon 725.*
Dichromena polystachys Turril, *Mayor 282.*
Dichromena radicans Cham. & Schlecht., *Mayor 281.*
Dichromena sp., *Chardon 566.*

PUCCINIA DOLORIS Speg. See *Puccinia Asteris* Duby.

PUCCINIA DUBIA Mayor. See *Puccinia Spegazzinii* De-Toni.

PUCCINIA ELEUTHERANTHERAE Diet. See *Puccinia Melampodii* Diet. & Holw.

PUCCINIA EPIPHYLLA (L.) Wettst. Verh. Zool.-Bot. Ges. Wein **35**: 541.

Puccinia Poarum Niels. Bot. Tidsskr. III. **2**: 34. 1877.

On POA ANNUA L., *Chardon 628; Toro 410.*

Poa pratensis Nielson, *Chardon 616, 631.*

Jørstad (Nyt. Mag. Naturv. **70**: 325–408. 1932) believes, as a result of his studies on European material that the name for this rust should be *Puccinia Poae-sudeticae* (Westend.) Jørstad.

Puccinia eragrostidicola sp. nov.

Uredosoris amphigenis, sparsis, ellipticis vel oblongis, parvis, 0.2 mm.-longis, quandoque confluentibus, tarde nudis, epidermide rupta visibili; paraphysibus plerumque clavatis, subincurvatis, 7–13 × 32–42 μ, membrana levi, 1–1.5 μ cr., hyalina; uredosporis late ellipsoideis vel obovoideis, 13–18 × 19–25 μ; membrana hyalina vel subhyalina, 1.5–2 μ cr., minute verrucoso-echinulata; poris obscuris.

Teleutosoris amphigenis, sparsis, oblongis vel linearibus, 0.4–0.8 mm. longis, mox nudis, atro-brunneis, epidermide rupta non visibili; teliosporis late ellipsoideis, 23–27 × 29–35 μ, septo non constrictis; membrana castaneo-brunnea, 2.5–3 μ cr., apice leniter incrassata ad 4–6 μ, levi; pedicello tincto, 5–6 μ lato, sporam aequante vel longiore, saepe oblique inserto.

On *Eragrostis inconstans* Nees, Quebrada de la Garcia, June 29, 1930, *Archer H–69.*

The genus *Eragrostis* seems to be rather free from rusts. In North America only *Uromyces Eragrostidis* is known. Arthur in his study of the grass rusts of South America (Proc. Am. Phil. Soc. **64**: 210. 1925) has reported only *U. Eragrostidis.* There is one *Puccinia* on this host-genus described from Ceylon by Petch and named *Puccinia Eragrostidis.* The teliospores in the Asiatic species are so much smaller, especially narrower (15–17 × 20–32 μ), that there seems little doubt as to the difference between it and our species.

PUCCINIA EUPATORII Diet. See *Uredo Eupatoriorum* Mayor.

PUCCINIA EUPATORIICOLA Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 513. 1913.

On *Eupatorium pycnocephalum* Less., *Mayor 44.*

Eupatorium Schiedeanum Less., *Mayor 228.*

A microcyclic species.

PUCCINIA EUPATORII-COLUMBIANI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 514. 1913.

On *Eupatorium columbianum* Heering, *Mayor 298.*

PUCCINIA EVADENS Harkn. Bull. Calif. Acad. **1**: 34. 1884.

On *Baccharis cassinaefolia* DC., *Chardon 64.*

PUCCINIA FEROX Diet. & Holw.; Holw. Bot. Gaz. **31**: 333. 1901.

Puccinia cundinamarcensis Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 536. 1913.

On *Verbesina* (?) *nudipes* Blake, *Chardon & Nolla 480; Mayor 69.*

Verbesina verbascifolia Walp., *Mayor 40.*

Verbesina sp., *Chardon & Nolla 449.*

Our studies lead us to consider *P. cundinamarcensis* a synonym of *P. ferox.* One of the chief differences was supposed to be in the walls of the spores. Mayor described his specimen as having smooth walls and *P. ferox* is said to appear smooth when wet but to be finely verrucose rugose. We find Mayor's specimen actually not smooth and we think the roughness of *P. ferox* over emphasized. *P. examinata* Jackson & Holw. differs in the thicker walls of the teliospores and in having the pore in the lower cell always close to the hilum.

PUCCINIA FILOPES Arth. & Holw. Mycologia **10**: 131. 1918.

On *Buettneria carthaginensis* Jacq., *Chardon & Nolla 382.*

PUCCINIA FIMBRISTYLIDIS Arth. Bull. Torrey Club **33**: 28. 1906.

On *Fimbristylis annua* (All.) R. & S., *Mayor 258.*

PUCCINIA FUHRMANNI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 507. 1913.

On *Justicia* cf. *secunda* Vahl. cf. var. *intermedia* (Nees) Thellung, *Mayor 62.*

PUCCINIA GLUMARUM (Schm.) Erikss. & Henn. Zeits. Pflanzenkr. **4**: 197. 1894.

On *Triticum aestivum* L. (var. Kota), *Chardon 635.*

PUCCINIA GONZALEZI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 502. 1913.

On *Capsicum* sp., *Mayor 365.*

A microcyclic species.

PUCCINIA GOUANIAE Holw. Ann. Myc. **3**: 21. 1905.
On *Gouania* sp., *Toro 293.*

PUCCINIA HETEROSPORA Berk. & Curt.; Berk. Jour. Linn. Soc. **10**: 356. 1869.
On *Abutilon umbellatum* (L.) Sweet, *Mayor 27.*
Anoda hastata Cav., *Toro 195.*
Bastardia viscosa (L.) H.B.K., *Mayor 15.*
Malvastrum peruvianum (L.) A. Gray, *Toro 409.*
Sida rhombifolia L., *Chardon 549.*
Sida spinosa L., *Chardon & Nolla 283; Chardon 30.*
Wissadula periplocifolia (L.) Presl., *Mayor 16* (not seen).
Malvaceae sp., *Chardon & Nolla 325, 395; Mayor 76, 314.*

PUCCINIA HUALLAGENSIS P. Henn. See *Puccinia claviformis* Lagerh.

PUCCINIA HYDROCOTYLES (Link) Cooke, Grevillea **9**: 14. 1880.
On *Hydrocotyle leucocephala* Cham., *Mayor 94.*
Hydrocotyle quinqueloba Ruiz & Pav. var. *stella* (Pohl.) Urban, *Mayor 61* (no rust on our specimen).
Hydrocotyle umbellata L., *Toro 249; Mayor 179.*

PUCCINIA HYPTIDIS Tracy & Earle, Bull. Miss. Agr. Exp. Sta. **34**: 86. 1895.
On *Hyptis capitata* Jacq. var. *vulgaris* Briq., *Mayor 224.*

PUCCINIA HYPTIDIS-MUTABILIS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 496. 1913.
On *Hyptis mutabilis* (Rich.) Briq. var. *polystachya* H.B.K., *Mayor 294.*
Hyptis mutabilis (Rich.) Briq. var. *spicata* (Poir.) Briq., *Mayor 121.*

PUCCINIA IMPEDITA Mains & Holw.; Arth. Mycologia **10**: 135. 1918.
On *Salvia petiolaris* H.B.K., *Toro 295.*

PUCCINIA IPOMOEAE-PANDURATAE Sydow. See *Puccinia crassipes* Berk. & Curt.

PUCCINIA LANTANAE Farl. Proc. Am. Acad. **18**: 83. 1883.
On *Lantana camara* L., *Toro 180.*
Lantana hispida H.B.K., *Mayor 212.*

Lantana tiliifolia Cham., *Mayor 28.*
Lantana trifolia L., *Mayor 214a.*

PUCCINIA LATERITIA Berk. & Curt. Jour. Phila. Acad. Sci. **2**: 281. 1853.

On *Borreria laevis* (Lam.) Griseb., *Toro 194, 376; Chardon & Nolla 327; Mayor 263.*
Borreria latifolia (Aubl.) Schum., *Chardon 548, 567, 587, 721.*
Diodia cymosa Cham., Tranvia del Oriente, 22 km. north of Medellin, Feb. 7, 1931, *Archer H–227.*

PUCCINIA LEONOTIDIS (P. Henn.) Arth. Mycologia **7**: 245. 1915.

Puccinia leonotidicola P. Henn. in H. Baum, Kun. Samb. Exp. 2. 1903.

On *Leonotis nepetaefolia* (L.) R. Br., *Chardon 554, 592; Chardon & Nolla 263, 359; Toro 558.*

PUCCINIA LEVIS (Sacc. & Bizz.) Magn. Ber. Deuts. Bot. Ges. **9**: 190. 1891.

Puccinia Paspali Tracy & Earle, Bull. Torrey Club *22*: 174. 1895.

On *Axonopus scoparius* (Fl.) Hitch., *Chardon 72; Archer H–76.*
Paspalum Fournierianum Ricker var. *maximum* Thellung, *Mayor 163.*
Paspalum pilosum Lam., *Chardon 75.*
Rytilix granularis (L.) Skeels (*Manisuris* Sw., *Hackelochloa* Kuntze), *Archer H–82.*

PUCCINIA LIABI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 539. 1913.

On *Liabum hastatum* (Wedd.) Britton, *Mayor 171.*

A microcyclic species. Reported also from Ecuador and Belivia by Jackson (Mycologia **24**: 179. 1932).

PUCCINIA LITHOSPERMI Ellis & Kellerm. Jour. Myc. **1**: 2. 1885.

On *Evolvulus villosus* Ruiz & Pav., Bello, June 19, 1930, *Archer H–59.*

This South American form agrees with the North American one described as *Puccinia Lithospermi.* Whether it should be regarded as a synonym of *Puccinia tuyatensis* according to Arthur

(N. Am. Flora **7**: 791) is a question which we cannot decide on account of a lack of authentic specimens for comparison.

Puccinia Lucumae sp. nov.

Uredosoris hypophyllis, sparsis, rotundatis, 0.2–0.5 mm. diam., pallide cinnamomeo-brunneis, mox nudis; epidermide rupta visibili; uredosporis globosis, late ellipsoideis vel obovoideis, 29–35 × 35–40 μ; membrana flavida vel brunneolo-flava, 3–5 μ cr., basi interdum tenuescenti, sparse valdeque echinulata, circa pedicellum levi; poris 2 vel 3, aequatorialibus.

Teleutosoris hypophyllis, sparsis, rotundatis vel ellipticis, 0.2–0.7 mm. diam., pallide castaneo-brunneis, epidermide rupta non visibili; teleutosporis late ellipsoideis, 27–32 × 35–45 μ, supra et infra rotundatis, cellula inferiore plerumque minore, septo non vel leniter constrictis; membrana aurato-brunnea, infra 1.5 μ cr., levi, supra incrassata ad 4–5 μ, minute verrucosa; pedicello subhyalino, sporam aequante vel breviore.

On *Lucuma* sp., Cafetal La Suiza, near Titiribi, Aug. 31, 1930, *Archer H–100.*

We do not find a *Puccinia* described on this host genus. There is a uredo form, *Uredo Lucumae,* which differs markedly in having a wall of two layers. There is a *Uromyces Lucumae* in Brazil but the urediniospores of it do not possess characters indicative of any correlation.

PUCCINIA MACROPODA Speg. See *Puccinia striolata* (Speg.) Arth.

PUCCINIA MALVACEARUM Bertero; Mont. in C. Gay, Fl. Chile **8**: 43. 1852.

Puccinia Sidae-rhombifoliae Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 484. 1913.

On *Malvastrum corchorifolium* (Desr.) Britton, *Chardon 589.*

Malvastrum coromandelianum (L.) Garcke, *Toro 177, 186; Chardon & Nolla 251, 321; Chardon 583; Mayor 240e.*

Malvastrum tricuspidatum A. Gray (*M. americanum* Torr.), *Chardon & Nolla 389.*

Malvastrum sp., *Chardon & Nolla 335.*

Sida rhombifolia L., *Mayor 241.*

PUCCINIA MARISCI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 474. 1913.

On *Mariscus flavus* Vahl., *Mayor 283.*

Mariscus hermaphroditus (Jacq.) Urban, *Mayor 278.*

PUCCINIA MAYERHANSI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 521. 1913.

On *Baccharis oronocensis* DC., *Toro 291; Mayor 170.*

The number *170* was used also under *Puccinia Ancizari.*

PUCCINIA MAYDIS Bereng. See *Puccinia Sorghi* Schw.

PUCCINIA MEDELLINENSIS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 497. 1913.

On *Hyptis pectinata* (L.) Poir., *Toro 271; Mayor 295.*

PUCCINIA MELAMPODII Diet. & Holw. Bot. Gaz. **24**: 32. 1897.

Puccinia Synedrellae P. Henn. Hedwigia **37**: 277. 1898.

Puccinia Eleutherantherae Diet. Ann. Myc. **7**: 354. 1909.

Puccinia Wedeliae Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 528. 1913.

On *Eleutheranthera ruderalis* (Sw.) Sch.-Bip., *Mayor 132; Toro 239; Chardon & Nolla 292, 332.*

Synedrella nodiflora (L.) Gaertn., *Chardon 96; Chardon & Nolla 323, 492; Mayor 102a.*

Wedelia caracasana DC., *Chardon 27.*

Wedelia Trichostephia DC., *Mayor 237.*

The microcyclic rusts on the closely related hosts, *Eleutheranthera, Synedrella,* and *Wedelia,* present a difficult problem. They have been described as separate species by as many workers. We have searched in vain for structural characters to separate them satisfactorily and are here following Arthur in the North American Flora where he has included them under *Puccinia Melampodii. Puccinia Baranquillae* and *P. spilanthicola* on *Spilanthes* and *Puccinia tolimensis* on *Eupatorium* are also very similar to the composite species *P. Melampodii* but we are maintaining them as separate species.

PUCCINIA MENTHAE Pers. Syn. Fung. 227. 1801.

On *Hyptis mutabilis spicata* (Poit.) Epl., *Chardon 643, 643b.*

PUCCINIA MONTOYAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 523. 1913.

On *Baccharis floribunda* H.B.K., *Mayor 18.*

PUCCINIA MONTSERRATES Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 520. 1913.

On *Baccharis bogotensis* H.B.K., *Mayor 56.*

PUCCINIA NARIÑENSIS Kern & Whetz. Jour. Dept. Agric. Puerto Rico **14**: 330. 1930.

On *Eupatorium* sp., *Toro 557.*

PUCCINIA OBLIQUA Berk. & Curt.; Berk. Jour. Linn. Soc. **10**: 356. 1869.

On *Exolobus* sp., Fredonia, Aug. 2, 1930, *Archer H–88.*

This appears to be the first report of this microcyclic rust on the genus *Exolobus* but it is known on several closely related genera of the family. This rust appears to be common in South America, as well as in Central America, the West Indies, and southern North America.

PUCCINIA ORTIZI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 503. 1913.

On *Brachistus* aff. *hebephyllus* Miers., *Mayor 25.*

A microcyclic species.

PUCCINIA OXALIDIS (Lév.) Diet. & Ellis; Diet. Hedwigia **34**: 291. 1895.

Uredo Oxalidis Lév. Ann. Sci. Nat. II. **16**: 240. 1841.

Trichobasis Oxalidis Lév. Ann. Sci. Nat. IV. **20**: 299. 1863.

On *Oxalis pubescens* H.B.K., *Toro 192*; reported by Léveillé.

Oxalis sp., *Chardon & Nolla 442.*

This appears to be the first rust ever reported from Colombia. It is listed by Léveillé in the Prodromus Florae Novo Granatensis Cryptogamie which was published in 1863.

PUCCINIA OYEDAEAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 535. 1913.

On *Oyedaea* aff. *buphthalmoides* DC., *Mayor 150.*

Mayor interpreted this species as a *Lepto-Puccinia.* Arthur (N. Am. Flora **7**: 431) has transferred this specific name to *Dicaeoma* and described pycnia, aecia, uredinia, and telia. Sydow has transferred the name to *Eriosporangium* (Ann. Myc. **20**: 122). According to Jackson both Arthur and Sydow are in error and the proper name for their Costa Rican specimens is *Puccinia Holwayula.* Jackson (Mycologia **24**: 161, 163. 1932) has found uredospores in Mayor's type which he describes as depressed globoid, 18–21 μ in diameter, with 5–6 pores which are subequatorial appearing sometimes scattered. Jackson gives a Key

for distinguishing this species from *P. boliviana* and *P. Holwayula*, the only other rusts on *Oyedaea* sp.

PUCCINIA PALLESCENS Arth. Bull. Torrey Club **46**: 111. 1919.
On *Zea Mays* L., *Chardon & Nolla 337, 509; Chardon 109.*

PUCCINIA PALLIDISSIMA Speg. Anal. Soc. Ci. Argent. **12**: 69. 1881.
Puccinia albida Diet. & Neg. Bot. Jahrb. **24**: 160. 1897.
On *Stachys Mayorii* Briq., *Mayor 166.*

PUCCINIA PARAMENSIS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 493. 1913.
On *Salvia cernua* H.B.K., *Mayor 83.*

Mayor thought this to be a *Micro-puccinia* but we find numerous urediniospores. They are globoid, 19–24 μ, wall thin, about 1 μ, pale cinnamon brown, finely echinulate, pores obscure. *Puccinia sana* Jackson & Holw. on *Salvia leucocephala* from Ecuador is similar but it seems to us to be distinct.

PUCCINIA PASPALI Tracy & Earle. See *Puccinia levis* (Sacc. & Bizz.) Magn.

PUCCINIA PITTIERIANA P. Henn. Hedwigia **43**: 147. 1904.
On *Solanum tuberosum* L., *Sacco 537* (com. *Toro*).

PUCCINIA POCULIFORMIS (Jacq.) Wettst. Verh. Zool.-Bot. Ges. Wien. **35**: 544. 1886.
Puccinia graminis Pers. Neues Mag. Bot. **1**: 119. 1794.
On *Agrostis perennans* (Walt.) Tuckerm., *Chardon 66.*
Anthoxanthum odoratum L., *Chardon 660, 664.*
Avena sativa L., *Chardon 632.*
Phleum pratense L., *Chardon 634.*
Stipa Neesiana Trin. & Rupr., *Chardon 619.*
Triticum aestivum L., *Chardon 622; Diaz 400.*

PUCCINIA POLYGONI-AMPHIBII Pers. Syn. Fung. 227. 1801.
On *Persicaria hydropiperoides* (Michx.) Small, *Chardon 662.*
Persicaria persicarioides (H.B.K.) Small, *Chardon 595.*
Persicaria punctata (Ell.) Small (*Polygonum acre* H.B.K.), *Chardon 32, 608; Toro 243; Mayor 168.*

PUCCINIA PRUNI-SPINOSAE Pers. See *Tranzschelia punctata* (Pers.) Arth.

PUCCINIA PSIDII Wint. Hedwigia **23**: 171. 1884.
Uredo Myrciae Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 590 1913.
On *Jambos Jambos* (L.) Millsp., *Toro 300; Chardon 18, 45; Archer H–156.*
Myrcia cf. *acuminata* (H.B.K.) DC., *Mayor 209.*
Myrcia sp., *Toro 306; Mayor 209a.*
Psidium sp., *Toro 308.*
Myrtaceae, Toro 196, 290, 245, 374.

PUCCINIA PUNCTATA Link, Ges. Nat. Freunde Berlin Mag. **7**: 30. 1815.
On *Relbunium hypocarpium* (L.) Hemsley, *Mayor 262b; Archer H–53.*

PUCCINIA PURPUREA Cooke, Grevillea **5**: 15. 1876.
On *Holcus Sorghum* L., *Chardon & Nolla 338.*

PUCCINIA PUTA Jackson & Holw. *in lit.*
Aecidium distinguendum Sydow, Monog. Ured. **4**: 131. 1923.
Puccinia distinguenda Jackson & Holw. Mycologia **23**: 497. 1931. Not *Puccinia distinguenda* Sydow. 1908.
On *Ipomoea carnea* Jacq., Puerto Colombia, Colombia, Jan. 3, 1933. *J. Dufrenoy.*
This specimen has been supplied by Mr. Cummings from the Arthur herbarium. It has been reported previously from Ecuador.

PUCCINIA RHAMNI (Pers.) Wettst. Verh. Zool.-Bot. Ges. Wien **35**: 545. 1886.
On *Agrostis perennans* (Walt.) Tuckerm., *Chardon 661, 708.*
Avena sativa L., *Toro 408.*

PUCCINIA RIVINAE (Berk. & Curt.) Speg. Anal. Mus. Nac. Buenos Aires **19**: 304. 1909.
On *Rivina humilis* L., Medellin, July 31, 1930, *Archer H–81.*
This is the first report of this species from Colombia.

PUCCINIA ROTUNDATA Diet. Hedwigia **36**: 32. 1897.
Puccinia rugosa Speg. Ann. Soc. Ci. Argent. **17**: 92. 1884. Not *P. rugosa* Billings 1871.
On *Vernonia brasiliana* (L.) Druce, *Chardon & Nolla 372.*
Vernonia patens H.B.K., *Toro 182; Mayor 176c.*

Vernonia scabra Pers., *Mayor 17; Smith* phan. spec. *613.*
Vernonia sp., *Toro 301, 302; Chardon & Nolla 358.*

PUCCINIA RUELLIAE (Berk. & Br.) Lagerh. Tromsö Mus. Aarch. **17**: 71. 1895.

Uredo balaensis Sydow, Ann. Myc. **1**: 21. 1903.

On *Blechum Brownei* Juss., *Mayor 181.*

We are following Arthur (N. Am. Flora **7**: 415. 1921) in considering the rusts on *Ruellia* and *Blechum* to be the same. Jackson (Mycologia **24**: 95. 1932) prefers to keep the *Blechum* rust separate under *Puccinia Blechi* Lagerh.

PUCCINIA RUGOSA Speg. See *Puccinia rotundata* Diet.

PUCCINIA RUIZENSIS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 486. 1913.

On *Oreomyrrhis andicola* (H.B.K.) Endlicher, *Mayor 67.*

The teliospore wall is very finely punctate and not smooth as stated in the original description. This fact has been pointed out in a letter received from Dr. Mayor.

PUCCINIA SALVIICOLA Diet. & Holw. See *Puccinia Ballotaeflorae* Long.

PUCCINIA SAMPERI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 537. 1913.

On *Chaenocephalus arboreus* (H.B.K.) O. Hoffm., *Mayor 12.*

A microcyclic rust resembling *Puccinia ferox* on *Verbesina* from which it differs chiefly in the larger size of the teliospores.

PUCCINIA SARACHAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 499. 1913.

On *Saracha edulis* (Schlecht.) Thellung, *Mayor 187.*
Saracha aff. *edulis* (Schlecht.) Thellung, *Mayor 188.*
Saracha Jaltomata Schlecht., *Toro* (no number).

A microcyclic species.

PUCCINIA SCHISTOCARPHAE Jackson & Holw. Am. Jour. Bot. **5**: 534. 1918.

On *Schistocarpha* sp., *Toro 255.*

PUCCINIA SCLERIAE (Paz.) Arth. Mycologia **9**: 75. 1917.

On *Scleria melaleuca* Cham. & Schlecht., *Mayor 284.*

Scleria neogranatensis C. B. Clarke, *C. H. Ballou H–93.*
Scleria sp., *Toro 233.*

It is difficult to determine these specimens which show uredinia only. In our earlier paper (Jour. Dept. Agric. Puerto Rico **14**: 335. 1930) we referred the Mayor and Toro specimens to *Puccinia scleriicola.* After studying the Mayor specimen and taking into consideration its host we believe the present disposition is to be preferred. Most certainly these are not *Uromyces Scleriae. Puccinia Scleriae* is known from Panama on *Scleria melaleuca.* The Ballou specimen is placed here but not without some doubt.

PUCCINIA SCLERIICOLA Arth. See *Puccinia Scleriae* (Paz.) Arth.

PUCCINIA SIDAE-RHOMBIFOLIAE Mayor. See *Puccinia Malvacearum* Bertero.

PUCCINIA SMILACIS Schw. Schr. Nat. Ges. Leipzig 1: 72. 1822.
On *Smilax cumanensis* Willd., *Chardon 568.*

PUCCINIA SOLANICOLA Mayor. See *Puccinia claviformis* Lagerh.

PUCCINIA SOLANITA (Schw.) Arth. See *Puccinia claviformis* Lagerh.

PUCCINIA SOLEDADENSIS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 494. 1913.
On *Salvia ? pauciserrata* Benth., *Mayor 79.*

PUCCINIA SORGHI Schw. Trans. Am. Phil. Soc. II. **4**: 295. 1832.
Puccinia Maydis Bereng. Atti Sci. Ital. **6**: 475. 1845 (hyponym).
On *Zea Mays* L., *Toro 202; Chardon & Nolla 399; Mayor 222.*

PUCCINIA SPEGAZZINII De-Toni, in Sacc. Syll. Fung. **7**: 704. 1888.
Puccinia dubia Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 482. 1913.
Puccinia Convolvulacearum Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 488. 1913.
On *Mikania cordifolia* (L.) Willd., *Chardon 582, 698; Chardon & Nolla 277.*
Mikania scandens (L.) Willd., *Mayor 307.*
Mikania sp., *Toro 250, 360; Mayor 308b, 309, 315.*

Examination of Mayor's specimens *308b* and *309,* which were said to be on Convolvulaceae indet. and formed the basis of his species *Puccinia Convolvulacearum,* convinces us that they are on *Mikania* and that the rust belongs here. No. *308b* may be *M. scandens* and *309* may be *M. cordifolia.* Mayor's specimen no. *315* said to be on Ampelidaceae and used as the type of *Puccinia dubia* appears without doubt to be a *Mikania* and to belong here.

PUCCINIA SPILANTHICOLA Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 531. 1913.

On *Spilanthes americana* (Mutis) Hieron., *Mayor 246a, 248.*
Spilanthes ciliata H.B.K., *Chardon & Nolla 326, 528; Chardon 571, 695.*

Except for the mesospores, which are numerous in this species, it is very like *Puccinia Melampodii.*

PUCCINIA STEIRACTINIAE Jackson & Holw. Mycologia **24**: 168 1932.

Aecidium Gymnolomiae Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 574. 1913. Not *Puccinia Gymnolomiae* Diet. & Holw. 1904.

On *Steiractinia* sp., *Mayor 35* (listed by Mayor as *Gymnolomia quitensis* (Benth.) Benth. & Hooker).

Mayor described *Aecidium Gymnolomiae* as a new species with his no. *35* as type specimen. He overlooked some uredinia and telia which occur on the underside of these leaves which bear aecia on the upper surfaces. We have submitted the specimen to Dr. S. F. Blake, U. S. Department of Agriculture, who says the host is *Steiractinia* sp. Jackson has described *Puccinia Steiractiniae* which seems to us to agree perfectly with the Mayor specimen. Jackson's specimen is from Ecuador on *S. Rosei.* Among some undetermined collections kindly sent us by Dr. Mayor we have found one, no. *326,* which agrees with no. *35* fairly well as to the rust but Dr. Blake says the host is presumably *Wedelia Jacquini caracasana* (DC.) O. E. Schultz. The rust, however, does not agree with any rust known to us on *Wedelia.*

PUCCINIA STRIOLATA (Speg.) Arth. Mem. Torrey Club **17**: 142. 1918.

Puccinia macropoda Speg. Anal. Soc. Ci. Argent. **10**: 8. 1880.
On *Iresine* sp., *Mayor 52.*

PUCCINIA SUBCORONATA P. Henn. Hedwigia **34**: 94. 1895.
Puccinia antioquiensis Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 473. 1913.
On *Cyperus diffusus* Vahl., *Mayor 276.*

PUCCINIA SUBDIGITATA Arth. & Holw.; Arth. Am. Jour. Bot. **5**: 468. 1918.
On *Brachypodium mexicanum* Link, *Chardon 609, 611.*

PUCCINIA SUBSTRIATA Ellis & Barth. Erythea **5**: 47. 1897.
Uredo Henningsii Sacc. Syll. Fung. **17**: 456. 1905.
On *Chaetochloa geniculata* (Lam.) Millsp., *Chardon & Nolla 324.*
Paspalum paniculatum L., *Chardon & Nolla 478.*

PUCCINIA SYNEDRELLAE P. Henn. See *Puccinia Melampodii* Diet. & Holw.

PUCCINIA TAGETICOLA Diet. & Holw.; Holw. Bot. Gaz. **24**: 26. 1897.
On *Tagetes microglossa* Benth., *Mayor 233.*
Tagetes patula L., *Toro 244.*

PUCCINIA TOLIMENSIS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 516. 1913.
On *Eupatorium turbacense* Hieron., *Toro 343.*
Eupatorium turbacense Hieron. var. *ovalifolium* Hieron., *Toro 292; Chardon 588.*
Eupatorium sp. *Mayor 64.*
A microcyclic species.

PUCCINIA TUBULOSA (Pat. & Gaill.) Arth. Am. Jour. Bot. **5**: 464. 1918.
Uredo paspalicola P. Henn. Hedwigia **44**: 57. 1905.
On *Paspalum conjugatum* Berg., *Toro 253; Chardon & Nolla 321; Mayor 165a.*
Paspalum Humboldtianum Flügge, *Chardon 697.*
Paspalum paniculatum L., *Chardon & Nolla 271, 434; Chardon 540.*

PUCCINIA VERNONIAE-MOLLIS Mayor, Mem. Soc. Neuch. Sci Nat. **5**: 510. 1913.

On *Vernonia* cf. *mollis* H.B.K., *Mayor 172.*
Vernonia sp., *Chardon 591.*

The transfer of *Aecidium Vernoniae-mollis* Mayor to this species (Jour. Dept. Agric. Puerto Rico **14**: 339. 1930) was an error. See note under *Coleosporium Vernoniae.*

PUCCINIA WEDELIAE Mayor. See *Puccinia Melampodii* Diet. & Holw.

PUCCINIA VON GUNTENI Mayor. See *Prospodium Von Gunteni* (Mayor) Kern & Whetz.

Puccinia zexmeniicola sp. nov.

Teleutosoris plerumque hypophyllis, gregariis, quandoque in greges 1–2 mm. dia., plus minusve confluentibus, in maculis flavis insidentibus, minutis, rotundatis, 0.1–0.3 mm. diam., mox nudis, pulvinatis, compactis, primum castaneo-brunneis, dein germinando cinerascentibus; epidermide rupta inconspicua; teliosporis fusiformibus vel oblongis, 13–19 × 42–48 μ, apice et basi attenuatis, ad septum leniter constrictis; membrana pallide flavida vel hyalina, 1–1.5 μ cr., apice valde incrassata, 5–10 μ, levi; pedicello hyalina, brevi, sporam dimidiam aequante vel breviore.

On *Zexmenia iners* S. F. Blake, Quebrada de Itagui, Medellin, May 30, 1930 *Archer H–19.*

The only other known micro-*Puccinia* on *Zexmenia, P. absicca* Jackson & Holw. from Costa Rica, has teliospores ellipsoid, brown, with hyaline umbos over the pores, and verrucose-rugose walls. This species seems to be quite distinct.

PUCCINIOSIRA Lagerh. Ber. Deuts. Bot. Ges. **9**: 344. 1891.

PUCCINIOSIRA PALLIDULA (Speg.) P. Henn. Tromsö Mus. Aarsh. **16**: 122. 1894.
On *Malvaceae* sp. (probably *Triumfetta*) *Mayor 327.*
Pavonia paniculata Cav., *Mayor 192.*
Triumfetta semitriloba Jacq., *Toro 267.*
Triumfetta sp., *Chardon & Nolla 257, 342, 422, 491.*

RAVENELIA Berk. Gard. Chron. **10**: 132. 1853.

RAVENELIA INDIGOFERAE Tranz. Hedwigia **33**: 369. 1894.
On *Indigofera subulata* Vahl., *Toro 178.*
Indigofera suffruticosa Mill., *Chardon & Nolla 313.*

RAVENELIA INGAE (P. Henn.) Arth. N. Am. Fl. **7**: 132. 1907.
Uromyces porcensis Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 459. 1913.

On *Inga adenophylla* Pittier, *Toro 190.*
Inga edulis Mart., *Chardon 110.*
Inga cf. *ingoides* (Rich.) Willd., *Mayor 311.*
Inga spuria H. & B., *Archer H–34.*
Inga sp., *Chardon & Nolla 437, 448, 490; Archer H–155; Chardon 90.*

RAVENELIA MAINSIANA Arth. & Holw. Am. Jour. Bot. **5**: 426. 1918.

On *Mimosa albida* H.B.K., *Chardon 4.*

Ravenelia Mimosae-pudicae sp. nov.

Uredosoris hypophyllis, sparsis vel in greges circinatim dispositis, rotundatis, 0.1–0.2 mm. diam., tandem poro centrali apertis, rufo-brunneis; paraphysibus cylindraceis, clavatis, vel spathulatis, 7–12 × 26–32 μ; membrana tenui, 1 μ, apice quandoque incrassata ad 2-6 μ, hyalina; uredosporis ellipsoideis vel obovoideis, 13–18 × 18–23 μ; membrana hyalina, 1–1.5 μ cr., minute verrucosoechinulata; poris obscuris, 6–8, sparsis.

Teleutosporis ignotis.

On *Mimosa pudica* L., Itagui, Aug. 17, 1930, *Archer H–108.*

It seems odd that a rust has not been described heretofore on *Mimosa pudica* as this plant has been examined frequently by collectors. The combination of characters is such as to make this species distinct from others on closely related species of *Mimosa.*

RAVENELIA MIMOSAE-SENSITIVAE P. Henn. Hedwigia Beibl. **35**: 246. 1896.

On *Mimosa sensitiva* L., *Mayor 174.*

RAVENELIA PITHECOLOBII Arth. Bot. Gaz. **39**: 394. 1905.

On *Pithecolobium lanceolatum* Benth. (genus name also written *Pithecellobium*), *Chardon & Nolla 374.*

SPIRECHINA COLUMBIENSIS Kern & Whetz. See *Mainsia columbiensis* (Kern & Whetz.) Kern, Thurst. & Whetz.

SPIRECHINA CUNDINAMARCENSIS (Mayor) Diet. See *Mainsia cundinamarcensis* (Mayor) Jackson.

SPIRECHINA LAGERHEIMII (P. Magn.) Kern & Whetz. See *Mainsia Lagerheimii* (P. Magn.) Jackson & Holw.

SPIRECHINA LOESENERIANA (P. Henn.) Arth. See *Kuehneola Loeseneriana* (P. Henn.) Jackson & Holw.

SPIRECHINA QUITENSIS (Lagerh.) Kern & Whetz. See *Mainsia Mayorii* Jackson.

SPIRECHINA RUBI-URTICIFOLII (Mayor) Kern & Whetz. See *Mainsia Rubi-urticifolii* (Mayor) Jackson.

SPIRECHINA VARIABILIS (Mayor) Diet. See *Mainsia variabilis* (Mayor) Jackson & Holw.

TRANZSCHELIA Arth. Result. Sci. Congr. Bot. Vienne 340. 1906.

TRANZSCHELIA PUNCTATA (Pers.) Arth. Result. Sci. Congr. Bot. Vienne 340. 1906.

Puccinia Pruni-spinosae Pers. Syn. Fung. 226. 1801.

On *Amygdalus Persica* L., *Chardon & Nolla 436; Mayor 5; Chardon 28.*

UREDINOPSIS Magn. Atti Congr. Bot. Genova 167. 1893.

UREDINOPSIS MAYORIANA Diet. Mem. Soc. Neuch. Sci. Nat. **5**: 556. 1913.

On *Blechnum blechnoides* Lag., *Mayor 182b.*

No telia are known but the urediniospores and sori indicate the correctness of the reference to the genus *Uredinopsis.*

UREDINOPSIS MACROSPERMA (Cooke) Magn. Hedwigia **43**: 122. 1904.

Uredinopsis Pteridis Diet. & Holw. Ber. Deuts. Bot. Ges. **13**: 331. 1895.

On *Pteridium aquilinum* (L.) Kuhn., *Mayor 183.*

UREDO (Form genus).

UREDO AESCHYNOMENIS Arth. See *Phakopsora Aeschynomenis* Arth.

UREDO AGERATI Mayor. See *Puccinia Conoclinii* Seym.

UREDO AMAGENSIS Mayor. See *Uromyces Hedysari-paniculati* (Schw.) Farl.

UREDO ANISODERMA Sydow, Monog. Ured. **4**: 400. 1924.
Uredo Vernoniae Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 594. 1913. Not *Uredo Vernoniae* P. Henn. 1908.
On *Vernonia* cf. *mollis* H.B.K., *Mayor 172g.*

This is an unusual form. The sori are small, grouped, long covered by the epidermis. They have somewhat the appearance of large pycnia. The spores are peculiar, being colorless and thicker above. Its identity is doubtful.

UREDO ANTHURII (Hariot) Sacc. Syll. Fung. **11**: 229. 1895.
On *Anthurium* sp., *Chardon & Nolla 458.*

A rare species but now known also from Puerto Rico and Santo Domingo as well as the type locality in France.

Uredo Archeriana sp. nov.

Uredosoris hypophyllis, plerumque gregatis nervos sequentibus, rotundatis, minutis, 0.2–0.4 mm. diam., mox nudis, pulverulentis, castaneo-brunneis; epidermide rupta inconspicua; uredosporis late ellipsoideis vel obovoideis, 23–26 × 32–42 μ; membrana cinnamomeo-brunnea, 1.5–2 μ cr., prominenter spinis hyalinis conicis echinulata; poris 2, subinde 3, subaequatorialibus.

On *Salvia latens* Benth., Sta. Elena, Dec. 28, 1930, *Archer H–201.*

There are numerous rusts described on the genus *Salvia* but this collection does not agree with any of them. In the described species the urediniospores are comparatively small and globoid or depressed globoid whereas these are large and ellipsoid or obovoid. It seems quite distinct. No teliospores have been found.

UREDO ARTOCARPI Berk. & Br. Jour. Linn. Soc. **14**: 93. 1873.
On *Artocarpus communis* Forst., *Chardon & Nolla 282.*

UREDO BACCHARIDIS-ANOMALAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 597. 1913.
On *Baccharis anomala* DC., *Mayor 68.*

Concerning a closely related species, *Puccinia improcera*, on this host from Brazil see Jackson (Mycologia **24**: 145. 1932).

UREDO BALAENSIS Sydow. See *Puccinia Ruelliae* (Berk. & Br.) Lagerh.

UREDO CALEAE Mayor. See *Puccinia Caleae* Arth.

UREDO CAMELIAE Mayor. See *Puccinia Cameliae* (Mayor) Arth.

UREDO CAUCENSIS Mayor. See *Crossopsora caucensis* (Mayor) Kern, Thurst. & Whetz.

UREDO CHERIMOLIAE Lagerh. Bull. Soc. Myc. Fr. **11**: 215. 1895.
On *Annona Cherimolia* Mill., *Chardon & Nolla 243; Chardon 2, 126, 711.*

UREDO CORDIARUM Kern & Whetz. Jour. Dept. Agric. Puerto Rico **14**: 344. 1930.
On *Cordia cylindrostachya* (R. & P.) Ros., *Chardon 646.*

UREDO CUNDINAMARCENSIS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 591. 1913.
On *Apium ternatum* (Willd.) Thellung var. *ranunculifolium* (H.B.K.) Thellung, *Mayor 30.*

UREDO CUPHEAE P. Henn. Hedwigia **34**: 99. 1895.
On *Cuphea serpyllifolia* H.B.K., *Mayor 198a.*
Cuphea strigulosa H.B.K., *Chardon 702.*
Parsonsia pinto (Vand.) Hiller, *Chardon 31, 69.*
Parsonsia racemosa (L. f.) Standley, *Chardon & Nolla 452.*
Parsonsia sp., *Toro 176, 193.*

UREDO CYATHULAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 584. 1913.
On *Cyathula achyranthoides* (H.B.K.) Moq., *Mayor 80.*

UREDO DICHROMENAE Arth. See *Puccinia Dichromenae* (Arth.) Jackson.

UREDO EUPATORIORUM Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 596. 1913.
On *Eupatorium ballotifolium* H.B.K., *Mayor 219.*
Eupatorium densum Benth., *Chardon 649.*
Eupatorium guadalupense Spreng., *Mayor 227.*
Eupatorium iresinoides H.B.K., *Mayor 191a.*
Eupatorium Vargasianum DC., *Mayor 162.*

There are several rusts on the genus *Eupatorium* which are so near identical in the uredinial stage that it is practically impossible to separate them. Among these are *Puccinia Eupatorii* Diet., *Puccinia Conoclinii* Seym., and *Puccinia Eupatorii-Columbiana* Mayor. For this reason it seems wise to retain *Uredo Eupatoriorum* Mayor to which we are referring all of the Colombian specimens on *Eupa-*

torium which have only uredo present. It should be noted that *Uredo Eupatoriorum* had previously been included as a synonym of *Puccinia Conoclinii* (Jour. Dept. Agric. Puerto Rico **14**: 321. 1930).

UREDO GOSSYPII Lagerh. See *Cerotelium desmium* (Berk. & Br.) Arth.

UREDO GUACAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 583. 1913.

On *Epidendrum* sp., *Mayor 108.*

UREDO HENNINGSII Sacc.

This name is a synonym of *Puccinia substriata* Ellis & Barth. but the specimen on *Panicum lanatum* Sw. no. *242* referred to this species by Mayor is in this paper included under *Uromyces costaricensis* Sydow.

UREDO HYMENAEAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 585. 1913.

On *Hymenaea* sp., *Mayor 149.*

UREDO HYPOXIDIS P. Henn. See *Uromyces affinis* Wint.

UREDO HYPTIDIS-ATRORUBENTIS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 593. 1913.

On *Hyptis atrorubens* Poir., *Mayor 238.*

UREDO JATROPHICOLA Arth. Mycologia **7**: 331. 1915.

On *Jatropha gossypifolia* L., *Chardon & Nolla 427.*

UREDO KYLLINGIAE P. Henn. Hedwigia **35**: 256. 1896.

On *Kyllingia brevifolia* Rottb., *Mayor 279a.*
Kyllingia odorata Vahl., *Mayor 280.*
Kyllingia sp., *Chardon 677.*

UREDO MANDEVILLAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 591. 1913.

On *Mandevilla* cf. *mollisima* (H.B.K.) K. Schum., *Mayor 226.*

Reported also from Trinidad (Sydow, Monog. Ured. **4**: 432. 1924).

UREDO MYRCIAE Mayor. See *Puccinia Psidii* Wint.

UREDO NEPHROLEPIDIS Diet.; Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 576. 1913.
On *Nephrolepis pendula* Raddi., *Mayor 151a.*

UREDO NOCIVIOLA Jackson & Holw. Mycologia **18**: 144. 1926.
On *Cyperus ferax* L. C. Rich., *Chardon & Nolla 212.*

Through the kindness of Dr. Jackson we have had opportunity to examine the type of *U. nociviola* and find that our specimen agrees as to size, color, markings, and pores of the spores.

UREDO PASPALICOLA P. Henn. See *Puccinia tubulosa* (Pat. & Gaill.) Arth.

? UREDO PEPEROMIAE P. Henn. Hedwigia **38**: 69. 1899.
On *Piper antioquiense* C. DC., *Chardon & Nolla 461.*

UREDO PIPERIS P. Henn. Hedwigia Biebl. **38**: 70. 1899.
On *Piper Hartwigianum* C. DC., *Chardon & Nolla 462.*

UREDO SALVIARUM Mayor. See *Puccinia Ballotaeflorae* Long.

UREDO SCABIES Cooke, Grevillea **15**: 18. 1886.
On *Vanilla planifolia* Griseb., reported from Colombia by G. Lindau (Orchis **9**: 177. 1915).

UREDO TERAMNI Mayor. See *Phakopsora Vignae* (Bres.) Arth.

UREDO THERESIAE Neger, Beih. Bot. Centralb. B. **13**: 8. 1903.
On *Crotalaria anagyroides* H.B.K., Therese, Prinzessin von Bayern.

UREDO TOLIMENSIS Kern & Whetz. Jour. Dept. Agric. Puerto Rico **14**: 347. 1930.
On *Solanum* sp., *Chardon 569.*

UREDO TORULINI P. Henn. Hedwigia **44**: 57. 1905.
On *Torulinum ferax* (L. C. Rich.) Urban, *Mayor 133.*

Through the kindness of Dr. W. H. Weston, of the Farlow Herbarium, we have had the opportunity to examine Mayor's specimen. We find that Mayor was right in saying that his specimen agreed well with the description of Hennings. Nothing was said in the original description about pores. They are apparently 2, equatorial. The markings are perhaps better described as verrucose-echinulate than as verrucose.

UREDO UNILATERALIS Arth. Bull. Torrey Club **45**: 155. 1918.
On *Geranium hirtum* Willd:, *Chardon 596.*
Geranium mexicanum H.B.K., *Mayor 33.*

Mayor called his collection no. *33, Uromyces Geranii* but there is no question that it belongs here as the uredospores have the typical reniform shape with one pore on the concave side. The specimen on *Geranium hirtum* has on it an aecial form in addition to the uredo (See Kern & Whetzel, 1930, p. 347). These aecia differ from *Aecidium bogotense* Mayor in the smaller spores and lack of peridium. No telial stage is known. Jackson reports this species from Ecuador.

UREDO VERNONIAE Mayor. See *Uredo anisoderma* Sydow.

UREDO ZEUGITIS Arth. & Holw.; Arth. Am. Jour. Bot. **5**: 538. 1918.
On *Zeugites mexicana* (Kunth.) Trin., *Chardon 52.*

UROMYCES Unger, Exanth. Pfl. 277. 1833.

UROMYCES AFFINIS Wint. Hedwigia **24**: 259. 1885.
Uredo Hypoxidis P. Henn. Hedwigia **40**: 173. 1901.
On *Hypoxis decumbens* L., *Mayor 230a.*

UROMYCES ANTIOQUIENSIS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 445. 1913.
On *Rynchospora polyphylla* Vahl., *Mayor 261.*

This species differs from *U. Rhyncosporae* Ellis and *U. oblectaneus* Jackson & Holw. in the uredinial characters. Both the sori and spores are lighter colored in the Mayor species and there are also differences in the thickness and wall markings.

UROMYCES APPENDICULATUS (Pers.) Fries, Summa. Veg. Scand. 514. 1849.
On *Phaseolus lunatus* L., *Chardon 81, 648; Chardon & Nolla 280a.*
Phaseolus vestitus Hooker, *Archer H–101.*
Phaseolus vulgaris L., *Toro 203; Chardon 298; Chardon & Nolla 530; Archer H–6.*
For rust on *Vigna* see *Uromyces Vignae.*

UROMYCES ASCLEPIADIS (Schw.) Cooke, Grevillea **5**: 152. 1879.
On *Asclepias curassavica* L., *Chardon & Nolla 328.*

UROMYCES BIDENTICOLA (P. Henn.) Arth. Mycologia **9**: 71. 1917.

On *Bidens cynapifolia* H.B.K., *Mayor 100.*
Bidens pilosa L., *Chardon 61, 104, 586; Mayor 211e.*
Bidens squarrosa H.B.K., *Chardon 645; Mayor 42.*

This is a macrocyclic species of which uredinia and telia are known. It is not to be confused with *U. Bidentis* Lagerh., a microcyclic species which is known on *Bidens pilosa.* Mayor (p. 470) reported this species from Colombia on *B. pilosa* and *B. squarrosa* but called it *U. Bidentis* in error. Reference to the host *B. bipinnata* (Mycologia *19*: 271. 1927) as from Colombia is also an error as that specimen was from Jamaica and not Colombia. The microcyclic species *U. Bidentis* is also reported from Colombia in this paper.

UROMYCES BIDENTIS Lagerh. Bull. Soc. Myc. Fr. **11**: 213. 1895.

On *Bidens pilosa* L., *Chardon & Nolla 450.*
See note under *Uromyces bidenticola.*

UROMYCES CESTRI (Mont.) Lév. Ann. Sci. Nat. III. **8**: 371. 1847.

On *Cestrum parviflorum* Dun., *Toro 406.*
Cestrum sp., *Toro 366.*

UROMYCES CISSAMPELIDIS Diet.; Earle, Bull. Torrey Club **26**: 632. 1899.

On *Cissampelos* sp., *Baker 83.*

UROMYCES COLUMBIANUS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 467. 1913.

On *Melanthera aspera* (Jacq.) Steudel, *Chardon 120; Mayor 293.*
Melanthera aspera (Jacq.) Steudel var. *canescens* (O. Kuntz) Thellung, *Mayor 148.*

UROMYCES COMMELINAE (Speg.) Cooke, Trans. Roy. Soc. Edinb. **31**: 342. 1888.

Uromyces Spegazzinii Arth., Bull. Torrey Club **37**: 573. 1910.

On *Tradescantia cumanensis* Kunth, *Toro 207.*
Tradescantia multiflora L., *Mayor 178; Archer H–49.*

UROMYCES COSTARICENSIS Sydow, Ann. Myc. **23**: 312. 1925.

On *Lasiacis ruscifolia* (H.B.K.) Hitchc., *Toro 179.*

Lasiacis sorghoidea (Desv.) Hitchc. & Chase (*Panicum lanatum* Sw.), *Chardon & Nolla 439, 514; Mayor 242.*

Mayor originally referred his collection, no. *242*, to *Uredo Henningsii*. In studying his specimen we have found teliospores as well as urediniospores. In our previous paper (Jour. Dept. Agric. Puerto Rico **14**: 315) we referred all the specimens listed here to *Uromyces leptodermus*. Since that time we have had for examination the type specimens of *U. leptodermus* and *U. costaricensis* and have reached the conclusion that all of these collections are properly referred to the latter. For further discussion see paper by Thurston entitled The Standing of Two Species of *Uromyces* on *Panicum* (Mycologia **25**: 442–445. 1933).

UROMYCES CRUCHETI Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 464. 1913.

On *Borreria tenella* (H.B.K.) Cham. & Schlecht., *Mayor 264. Rubiaceae* undet., *Toro 265.*

Sydow (Ann. Myc. **28**: 37. 1930) says the Mayor specimen may belong to the genus *Borreria* but that it is not the species *B. tenella*.

UROMYCES CUNDINAMARCENSIS Mayor. See *Mainsia cundinamarcensis* (Mayor) Jackson.

UROMYCES DOLICHOLI Arth. Bull. Torrey Club **33**: 27. 1906.

On *Rhynchosia* cf. *longeracemosa* Mart. & Gall., *Mayor 273.*

UROMYCES ERAGROSTIDIS Tracy, Jour. Myc. **7**: 281. 1893.

On *Eragrostis pilosa* (L.) Link, Escuela de Agricultura, Medellin, July 2, 1930, *Archer H–68;* Medellin, June 11, 1930, *Archer H–44.*

The collection no. *H–68* has an abundance of teliospores. This species has been reported from Brazil, Bolivia, and Ecuador by Arthur (Proc. Amer. Phil. Soc. **64**: 210. 1925) but this is the first report from Colombia.

UROMYCES EUPHORBIICOLA (Berk. & Curt.) Tranz. See *Uromyces proeminens* (DC.) Pass.

UROMYCES FABAE (Pers.) deBary, Ann. Sci. Nat. IV. **20**: 80. 1863.

On *Vicia Faba* L., *Toro 263; Archer H–189.*

UROMYCES GERANII (DC.) Ott. & Wartm. as used by Mayor, p. 462.

Error for *Uredo unilateralis* Arth.

UROMYCES GURANIAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 466. 1913.

On *Gurania* sp., *Mayor 324*.

On Mayor's specimen no. *324* we have found urediniospores inter-mixed in sori with the teliospores. A few sori look as if they were uredinia with teliospores developing in them. The urediniospores are broadly ellipsoid or globoid, 15–19 × 19–26 μ, the wall is yellowish or pale cinnamon-brown, 1–1.5 μ thick, moderately echinulate, the pores 2, equatorial. We do not think the species is a lepto-*Uromyces*.

UROMYCES HEDYSARI-PANICULATI (Schw.) Farl.; Ellis, N. Am. Fungi *246*. 1879.

Uredo amagensis Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 584. 1913.

On *Desmodium mexicanum* Sweet, Therese, Prinzessin von Bayern.

Desmodium tortuosum (Sw.) DC., *Mayor 266*.

Desmodium sp., *Mayor 270*.

UROMYCES HYPERICI-FRONDOSI (Schw.) Arth. Bull. Minn. Acad. Sci. **2**[2]: 15. 1883.

On *Hypericum* aff. *uliginosum* H.B.K., *Mayor 75* (not seen).

Hypericum thesiifolium H.B.K., *Archer H–129*.

UROMYCES IRESINES Lagerh.; Sydow, Monog. Ured. **2**: 227. 1910.

On *Iresine paniculata* (L.) Kuntze, *Mayor 180b*.

UROMYCES JANIPHAE (Wint.) Arth. Mycologia **7**: 190. 1915.

On *Manihot utilissima* Pohl (*M. Manihot* Cockerell), *Baker 84; Archer H–56*.

In our previous paper (Jour. Agric. Puerto Rico **14**: 315. 1930) we listed the Baker specimen as *Uromyces Manihotis* P. Henn. as that was the name given it by Dietel (Bull. Torrey Club **26**: 632. 1899). Since that time we have had for study a part of the Baker collection made available through the kindness of Dr.

G. Samuelsson, of Stockholm. He has also furnished us a part of the type of *U. Manihotis* P. Henn. collected by E. Ule in Brazil. Dietel commented that Hennings described only teliospores in *U. Manihotis* but that on specimens received from Hennings he found also uredospores which corresponded exactly with Baker's no. *84*. Our portion of *U. Manihotis* does not have on it any urediniospores and we are still in doubt about the life-history and standing of that species. Our studies of Baker's no. *84* shows the urediniospores to be identical with what we call *Uromyces Janiphae* in North America. In addition we now have the Archer no. *H–56* from Medellin which is also identical. There seems to be no doubt that both these Colombian collections are the same as the rust which is more or less common on cultivated cassava in central Mexico and the West Indies.

UROMYCES LAGERHEIMII P. Magn. See *Mainsia Lagerheimii* (*P.* Magn.) Jackson & Holw.

UROMYCES LEPTODERMUS Sydow; Sydow & Butler, Ann. Myc. **4**: 430. 1906.

On *Panicum barbinode* Trin., *Chardon 5*.

On this specimen we find only urediniospores which makes the determination less certain than if teliospores were present. Since we have two specimens, one from St. Croix and one from Santo Domingo, on this same host with both uredinia and telia agreeing with *U. leptodermus* we are inclined to believe this reference is correct. See also note under *Uromyces costaricensis*.

UROMYCES LOESENERIANUS (P. Henn.) Sydow. See *Kuehneola Loeseneriana* (P. Henn.) Jackson & Holw.

UROMYCES MANIHOTIS P. Henn. See *Uromyces Janiphae* (Wint.) Arth.

UROMYCES MAYORII Tranz.; Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 463. 1913.

On *Euphorbia orbiculata* H.B.K., *Mayor 50*.

According to the original description this is a mycrocyclic species with an unlimited mycelium. The teliospores themselves are very like the teliospores of *U. proëminens*. Arthur & Cummins have described (Ann. Myc. **31**: 44. 1933) a microcyclic species with

systemic mycelium and similar spores on *Euphorbia lata* from Colorado, Kansas, and Texas. They have named the species *U. largus*. Through the kindness of Dr. Arthur we have had the type for examination and have failed to find any reason to keep it separate from *U. Mayorii*. There is also a Stevens specimen from Peru on *E. orbiculata* that has been called *U. proëminens* which undoubtedly belongs here.

UROMYCES MEGALOSPERMUS Speg. Anal. Mus. Nac. Buenos Aires 218. 1899.

On *Tessaria integrifolia* Ruiz. & Pav., *Toro 242; Chardon 3; Mayor 254.*

UROMYCES NERVIPHILUS (Grognot) Barth. Handb. N. Am. Ured. 69. 1928.

On *Trifolium repens* L., *Toro 407, 411.*

UROMYCES NEUROCARPI Diet. Hedwigia **34**: 292. 1895.

On *Martiusia rubiginosa* (Juss.) Britton, *Toro 368.*

UROMYCES PHTIRUSAE Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 448. 1913.

On *Phtirusa pyrifolia* (H.B.K.) Eichler, *Mayor 169.*

The strongly striate spores described by Mayor as teliospores are in reality urediniospores. Genuine 1-celled teliospores are present which go to show that this is a *Uromyces*. For discussion see Jackson, Mycologia **19**: 54. 1927.

UROMYCES POLYMNIAE (P. Henn.) Diet. & Holw. Bot. Gaz. **31**: 327. 1901.

On *Polymnia glabrata* DC., *Mayor 11.*

We have compared the Mayor collection with the type specimen of *Uromyces Polymniae* and find that it agrees very well. We do not think that the pores are either two equatorial or subequatorial as they have been reported. We find three or four pores and cannot make out any definite arrangement.

UROMYCES PORCENSIS Mayor. See *Ravenelia Ingae* (P. Henn.) Arth.

UROMYCES PROËMINENS (DC.) Pass. Rab. Fungi Eur. *1795.* 1873.

Uromyces euphorbiicola Tranz. Ann. Myc. **8**: 8. 1910.

On *Chamaesyce brasiliensis* (Lam.) Small (*Euphorbia brasiliensis* Lam.), *Toro 240.*

Chamaesyce hirta (L.) Millsp. (*Euphorbia pilulifera* L.), *Chardon & Nolla 254, 360, 397; Chardon 22, 116; Mayor 201b; Archer H–209.*

UROMYCES QUITENSIS Lagerh. See *Mainsia Mayorii* Jackson.

UROMYCES RUBI-URTICIFOLII Mayor. See *Mainsia Rubi-urticifolii* (Mayor) Jackson.

UROMYCES SCLERIAE P. Henn. See *Puccinia Scleriae* (Paz.) Arth.

UROMYCES SMILACIS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 448. 1913.

On *Smilax* sp., *Mayor 323.*

UROMYCES SOLANI Diet. & Holw. Bot. Gaz. **24**: 24. 1897.

On *Solanum* sp., *Chardon 675.*

UROMYCES SPEGAZZINII (De-Toni) Arth. See *Uromyces Commelinae* (Speg.) Cooke.

UROMYCES URBANIANUS P. Henn. Hedwigia **36**: 213. 1897.

On *Antidaphne Fendleri* Engler, *Archer H–94.*

Oryctanthus botryostachys Eichl., *Chardon & Nolla 435; Archer H–98.*

This is an opsis-form and both collections on *Oryctanthus* have aecia and telia present. The *Antidaphne* specimen has only aecia. *Aecidium Loranthi* Thuem. on *Loranthus* is very similar.

UROMYCES VARIABILIS Mayor. See *Mainsia variabilis* (Mayor) Jackson & Holw.

UROMYCES VIGNAE Barclay, Jour. Asiat. Soc. Bengal **60**: 211. 1891.

On *Vigna luteola* (Jacq.) Benth. *Mayor 272; Archer H–38.*

We are following Fromme (Phytopath. **14**: 67–79. 1924) in separating the rust on *Vigna* from *Uromyces appendiculatus.* The chief distinction is in the pore characters. Both have two pores but on *Vigna* they are more evident and superequatorial whereas in *U. appendiculatus* they are equatorial.

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Puccinia Malvacearum
Mandevilla cf. **mollisima**
Uredo Mandevillae
Manettia Toroi
Aecidium Manettiae
Manihot Manihot
See **Manihot utilissima**
Manihot utilissima
Uromyces Janiphae
Manisuris granularis
See **Rytilix granularis**
Mariscus flavus
Mariscus hermaphroditus
Puccinia Marisci
Martiusia rubiginosa
Uromyces Neurocarpi
Melanthera aspera
Melanthera aspera canescens
Uromyces columbianus
Mikania cordifolia
Puccinia Spegazzinii
Mikania Guaco
Endophylloides portoricensis
Mikania scandens

Mikania sp.
Puccinia Spegazzinii
Mimosa albida
Ravenelia Mainsiana
Mimosa pudica
Ravenelia Mimosae-pudicae
Mimosa sensitiva
Ravenelia Mimosae-sensitivae
Myrcia cf. **acuminata**
Myrcia sp.
Myrtaceae sp.
Puccinia Psidii
Nephrolepis pendula
Milesia columbiensis
Uredo Nephrolepidis
Oreomyrrhris andicola
Puccinia ruizensis
Oryctanthus botryostachys
Uromyces Urbanianus
Oxalis pubescens
Oxalis sp.
Puccinia Oxalidis
Oyedaea cf. **buphthalmoides**
Puccinia Oyedaeae
Panicum barbinode
Uromyces leptodermus
Panicum lanatum
See **Lasiacis sorghoidea**
Parsonsia pinto
Parsonsia racemosa
Parsonsia sp.
Uredo Cupheae
Paspalum conjugatum
Paspalum Fournierianum maximum
Puccinia levis
Paspalum Humboldtianum
Puccinia tubulosa
Paspalum macrophyllum
Puccinia Chaetochloae
Paspalum paniculatum
Puccinia substriata
Puccinia tubulosa
Paspalum pilosum
Puccinia levis
Paspalum prostratum
Puccinia atra
Pavonia paniculata
Pucciniosira pallidula
Pennisetum bambusiforme
Puccinia Cenchri
Persicaria hydropiperoides
Persicaria persicarioides
Persicaria punctata
Puccinia Polygoni-amphibii
Phaseolus lunatus
Phaseolus vestitus
Phaseolus vulgaris
Uromyces appendiculatus
Phleum pratense
Puccinia poculiformis
Phthirusa pyrifolia
Uromyces Phtirusae
Piper antioquiense
Uredo Peperomiae
Piper Hartwigianum
Uredo Piperis
Pithecolobium lanceolatum
Ravenelia Pithecolobii
Plumiera alba
Plumiera rubra
Plumiera sp.
Coleosporium domingense
Poa annua
Poa pratensis
Puccinia epiphylla
Polygonum acre
See **Persicaria punctata**
Polymnia glabrata
Uromyces Polymniae
Psidium sp.
Puccinia Psidii
Pteridium aquilinum
Uredinopsis macrosperma
Quamoclit angulata
Quamoclit coccinea
Coleosporium Ipomoeae
Relbunium hypocarpium
Puccinia punctata
Rhynchosia cf. **longeracemosa**
Uromyces Dolicholi
Rivina humilis
Puccinia Rivinae
Rosa sp.
Phragmidium disciflorum
Rubiaceae
Uromyces Crucheti

Rubus adenotrichos
Mainsia Rubi-urticifolii
Rubus glaucus
Mainsia Lagerheimii
Rubus peruvianus
Mainsia cundinamarcensis
Rubus urticifolius
Kuehneola Loesneriana
Mainsia Rubi-urticifolii
Rubus sp.
Mainsia columbiensis
Mainsia Lagerheimii
Mainsia Mayorii
Mainsia Rubi-urticifolii
Mainsia variabilis
Rynchospora polyphylla
Uromyces antioquiensis
Rytilix granularis
Puccinia levis
Salvia cataractarum
Puccinia Ballotaeflorae
Salvia cernua
Puccinia paramensis
Salvia latens
Uredo Archeriana
Salvia Mayorii
Puccinia Ballotaeflorae
Salvia palaefolia
(?) *Puccinia conturbata*
Salvia (?) **pauciserrata**
Puccinia soledadensis
Salvia petiolaris
Puccinia Ballotaeflorae
Puccinia impedita
Sapindaceae sp.
Puccinia Arechavelatae
Saracha edulis
Saracha cf. **edulis**
Saracha Jaltomata
Puccinia Sarachae
Schistocarpha sp.
Puccinia Schistocarphae
Scleria melaleuca
Scleria neogranatensis
Scleria sp.
Puccinia Scleriae
Serjania cf. **brevipes**
Serjania membranacea
Serjania sp.
Puccinia Arechavelatae
Setaria scandens
See **Chaetochloa scandens**
Sida rhombifolia
Puccinia heterospora
Puccinia Malvacearum
Sida spinosa
Puccinia heterospora
Smilax cumanensis
Puccinia Smilacis
Smilax sp.
Uromyces Smilacis
Solanum hirtum
Solanum cf. **myrianthum**
Solanum cf. **ovalifolium**
Solanum stramonifolium
Solanum torvum
Solanum cf. **torvum**
Puccinia claviformis
Solanum tuberosum
Puccinia Pittieriana
Solanum sp.
Puccinia claviformis
Uredo tolimensis
Uromyces Solani
Spilanthes americana
Spilanthes ciliata
Puccinia spilanthicola
Spilanthes urens
Puccinia Barranquillae
Stachys Mayorii
Puccinia pallidissima
Stachytarpheta cayennensis
See **Valerianodes cayennense**
Steiractinia sp.
Puccinia Steiractiniae
Stipa neesiana
Puccinia poculiformis
Synedrella nodiflora
Puccinia Melampodii
Tagetes microglossa
Tagetes patula
Puccinia tageticola
Teramnus uncinatus
Phakopsora Vignae
Tessaria integrifolia
Uromyces megalospermus

Torulinum ferax
Uredo Torulini
Tradescantia cumanensis
Tradescantia multiflora
Uromyces Commelinae
Trifolium repens
Uromyces nerviphilus
Triticum aestivum
Puccinia Clematidis
Puccinia glumarum
Puccinia poculiformis
Triumfetta semitriloba
Triumfetta sp.
Pucciniosira pallidula
Valerianodes cayennense
Endophyllum Stachytarphetae
Vanilla planifolia
Uredo Scabies
Verbesina (?) **nudipes**
Verbesina verbasifolia
Verbesina sp.
Puccinia ferox
Vernonia brasiliana
Puccinia rotundata
Vernonia Cotoneaster
Puccinia Becki
Vernonia cf. **mollis**
Coleosporium Vernoniae
Puccinia Vernoniae-mollis
Uredo anisoderma
Vernonia patens
Vernonia scabra
Puccinia rotundata
Vernonia sp.
Puccinia rotundata
Puccinia Vernoniae-mollis
Vicia Faba
Uromyces Fabae
Vigna luteola
Uromyces Vignae
Vitis sicyoides
See **Cissus sicyoides**
Vitis sp.
Phakopsora Vitis
See also **Cissus** sp.
Wedelia caracasana
Puccinia Melampodii
Wedelia carnosa
Endophyllum decoloratum
Wedelia Trichostephia
Puccinia Melampodii
Wissadula periplocifolia
Puccinia heterospora
Zea Mays
Puccinia pallescens
Puccinia Sorghi
Zeugites mexicana
Uredo Zeugitis
Zexmenia iners
Puccinia zexmeniicola

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LIFE HISTORY AND SYNONYMY OF PHYSALOSPORA GLANDICOLA

NEIL E. STEVENS

The recent report by O. C. Boyd [1] of a twig blight of several species of oak in Massachusetts, caused by a pyrenomycete makes desirable the prompt publication of information regarding the life history and synonymy of this fungus which otherwise might well have been delayed and included with a more general study ot species of this group.

By coincidence the fungus in question had at the time Boyd made his observations been a subject of study for several months on the basis of material from Toronto, Canada. In March, 1932, H. S. Jackson sent to us for identification excellent material of a pyrenomycete on oak collected by him near Toronto, Canada. The ascospores proved to be readily viable and single ascospore cultures grown on cornmeal in flasks under conditions described in earlier articles produced abundant pycnospores. The description here given is based on the Toronto material, though specimens of the Massachusetts material have also been deposited in the mycological collections of the Bureau of Plant Industry.

The fungus which for reasons given below has been designated as **Physalospora glandicola** (Schw.) comb. nov. has black erumpent stromata mostly 1 to 2 mm. in diameter scattered irregularly over the bark of the host. When cut across, pycnidia and perithecia, except when too old, show the snowy white contents characteristic of the genus *Physalospora*.

Perithecia as well as pycnidia being crowded together in the stromata are somewhat irregular in shape and size but rarely exceed 200 to 225 μ in diameter. The asci are regularly eight-spored and the ascospores while hyaline and non-septate up to the time they attain full size become light brown and usually two-septate before being discharged from the asci. The ascospores in this specimen are rather uniform in size being 14–16 $\times$ 30–35 μ.

[1] Pl. Dis. Reptr. Sup. **85**: 67. 1933.

Hyaline paraphyses or pseudoparaphyses of the irregular semi-anastomosing type peculiar to this group and more readily recognized than described are usually abundant.

Pycnospores, whether on the host or in culture, also remain hyaline and non-septate until nearly or quite full size. Their walls are thick and glassy in appearance as in pycnospores of the tropical fungus often called *Diplodia natalensis*. Later they regularly become one-septate and light brown. There are no conspicuous longitudinal markings. These pycnospores are wide in proportion to their length, measuring 18–25 × 12–17 μ, mostly 21–24 × 15–16 μ. The conidiophores are very short, sometimes only 3 μ, and the pycnospores often appear sessile. In stromatic characters, shape of asci, etc., this fungus does not differ significantly from related species already illustrated in this Journal.[2]

SEPTATE ASCOSPORES IN THE GENUS PHYSALOSPORA

The genus *Physalospora* is ordinarily considered as being characterized by one-celled hyaline ascospores. Continued study of fungi of this group results inevitably in the conviction that rigid adherence to these characters results in limitations so artificial as to be quite untenable. Over 50 years ago Ellis[3] in discussing variability in what he then called "*Sphaeria quercuum*" called attention to the fact that brown biseptate ascospores were to be found in all the different forms then under discussion but not within the asci. He said, "They occur but sparingly it is true, but a careful and patient search is sure to reveal their presence."

The substantial truth of Ellis' observation has been many times confirmed. Indeed, it is the rule rather than the exception to find in slides containing old ascospores, a few spores with two cross walls characteristically placed approximately equidistant from the median line. This is true in all the species studied which are usually described as having hyaline one celled ascospores. The fungus under consideration differs in this respect from the species recognized as typical of *Physalospora* merely in the frequency and

[2] Stevens, N. E. Two species of *Physalospora* on citrus and other hosts. Mycologia **18**: 206–217. 1926 (and earlier papers therein cited).

[3] Ellis, J. B. Reply to Dr. M. C. Cooke's criticism of paper on "Variability of *Sphaeria quercuum* Sz." Acad. Nat. Sci. Phila. Proceedings **1879**: 381–382. 1880.

regularity with which septation occurs in the ascospores and in the age of the spore at the time the septa develop. It can scarcely be seriously insisted that such a distinction is valid as a generic character.

SPECIMENS EXAMINED

Type or authentic specimens of the pycnidial stage of the following have been examined and seem to the writer identical with the fungus from Toronto. Slides of all of these have been deposited in the mycological collections of the Bureau of Plant Industry.

Sphæria gallae Schw. on oak gall collected at Bethlehem, Pennsylvania. Excellent material with abundant pycnospores from the original packet in the Schweinitz Herbarium at Philadelphia.

Sphaeropsis hyalina Berk. & Curt. on *Ribes rubra* from the Curtis collection. Our slides of this specimen contain only hyaline non-septate spores but their shape and thick walls warrant their inclusion here.

Sphaeropsis quercina Cooke & Ellis. A specimen collected on oak at Alcove, New York, March, 1893, distributed as No. *373*, Shear, New York Fungi, determined by Ellis. Hyaline to light tan non-septate pycnospores only but agreeing in size and appearance with the others here included.

Dothiorella quercina Cooke & Ellis distributed as Ellis' N. A. Fungi *3264*. The specimen we have contains hyaline non-septate spores only.

Archer [4] compared the morphological and cultural characters of this fungus from oak galls, oak twigs, and acorns. He was undoubtedly right in insisting (p. 38) that there are no valid distinctions between these fungi which were maintained as distinct species by Schweinitz, Starbäck and later writers. The oak twig fungus studied by Miss Ingram [5] and called *D. longispora* Ellis & Ev. by her seems, however, quite distinct.

In none of the specimens above listed have ascospores been discovered. The portion of Schweinitz' specimen of *Sphaeria*

[4] Archer, W. A. Morphological characters of some Sphaeropsidales in culture. Ann. Myc. **24**: 1–78. 1926.

[5] Ingram, D. E. A twig blight of *Quercus Primus* and related species. J. A. R. **1**: 339–346. 1914.

glandicola Schw. found in the Michener collection contains numerous ascospores, still hyaline mostly 12–15 × 28–33 μ and an occasional older biseptate ascospore.

The portion of Schweinitz' specimen examined by Starbäck contained pycnospores the size of which is given by him as 12–14 × 15–20 μ and thus from their shape obviously belong to this species. This specimen as the oldest named ascospore specimen seems to be properly considered the type specimen and the name of this species to be properly indicated as *Physalospora glandicola* (Schw.). Part of the type specimen on acorns collected by Schweinitz at Bethlehem, Pennsylvania, is in the Michener Herbarium, Bureau of Plant Industry, United States Department of Agriculture.

PHYSALOSPORA GLANDICOLA (Schw.) N. E. Stevens.

Synonyms based on examination of type or authentic specimens.

Perithecia and pycnidia

Sphaeria glandicola Schw. p. 214. Syn. fung. Amer. Bor. 1832.

Pycnidia only

Sphaeria gallae Schw. p. 207. do.

Sphaeropsis hyalina Berk. & Curt. 1874. Grevillea **2**: 179. 1874.

Sphaeropsis quercina Cooke & Ellis. 1876. Grevillea **5**: 32. 1876.

Dothiorella quercina (Cooke & Ellis) Ellis & Ev. N. A. Fungi *3264*. 1895.

Synonyms based on descriptions only.

Sphaeropsis gallae (Schw.) Berk. & Curt. Sacc. Syll. **3**: 300. 1884.

Dothiorella gallae (Schw.) Starb. Bih. Sv. Vet. Akad. Handl. **19** (3): 65. 1894.

Dothiorella glandicola (Schw.) Starb. do. **19** (3): 64.

Dothiorella gallae (Schw.) Ellis & Ev. N. Am. Pyren. 745. 1892.

Sphaeropsis gallae (Schw.) Archer. Ann. Myc. **24**: 37. 1926.

Botryodiplodia gallae (Schw.) Pet. & Sydow. Gatt. Pyren **1**: 152. 1926.

Pycnidia simple or compound in black erumpent stromata, on oak bark, mostly 1 to 2 mm. in diameter, pycnospores at first one-celled and hyaline, with a thick glassy wall, becoming light brown and septate with no obvious striations; 12–17 × 18–25 μ, mostly 15–16 × 21–24 μ.

Perithecia in stromata similar to the pycnidia or in the same ones. Variable in size up to 200 or 225 μ in diameter. Asci regularly eight-spored. Spores hyaline and non-septate later becoming light brown and usually two septate; 12–16 × 28–35 μ, mostly 14–15 × 30–33 μ.

U. S. DEPT. AGRIC.,
WASHINGTON, D. C.

A NEW HOLLYHOCK RUST [1]

J. J. Taubenhaus and Walter N. Ezekiel

(with 3 text figures)

The common hollyhock rust caused by *Puccinia Malvacearum* is not known to occur in the Southern Gulf States, nor has it yet been found in Texas on any of the malvaceous plants. It was therefore of great interest when, in May, 1932, specimens of a hollyhock rust were received from Goliad (Goliad County), Texas. A number of plantings of hollyhocks near Goliad had been seriously damaged by this disease. These specimens showed numerous rust pustules on all parts of the leaves, petioles, blooms, seed bracts, and even the seeds. Most of the sori appeared to result from secondary infection and were formed in concentric circles surrounding the older, central sori (fig. 1, 2). The pustules were covered by a thin, uniform mildew-like growth. This superficial growth resembled the fungus parasites sometimes seen on rust pustules, but was found instead to consist of the characteristic promycelia and sporidia from the germinating teliospores. It will be noted that the symptoms of this rust were different from those of the common hollyhock rust which is widespread in many of the Northern states. Pustules of *Puccinia Malvacearum* are ordinarily formed singly within a circular area of dead and discolored tissue, and secondary pustules are formed only occasionally, in the immediate vicinity of the original rust sorus.[2]

The pustules of the new rust contained typical teliospores, mostly of the mesospore or one-celled type. The remaining spores were two-celled (fig. 3) but distinctly different from the two-celled teliospores of *P. Malvacearum*. Most of the teliospores had germinated in place and produced typical promycelia with sporidia (fig. 3). The sporidia germinated readily in ordinary

[1] Published with the approval of the Director as contribution no. 266, Technical Series, of the Texas Agricultural Experiment Station.

[2] Taubenhaus, J. J. A contribution to our knowledge of the morphology and life history of *Puccinia Malvacearum* Mont. Phytopath. 1: 55–62. 1911.

tap-water or in a decoction made from hollyhock leaves. The organism was identified as *Puccinia heterospora* Berk. & Curt.[3] This rust is known to occur in the Bahamas, Costa Rica, Cuba, California, Guatemala, Jamaica, Porto Rico,[4] St. Thomas, and St. Croix. Seymour[5] mentions 17 different malvaceous hosts

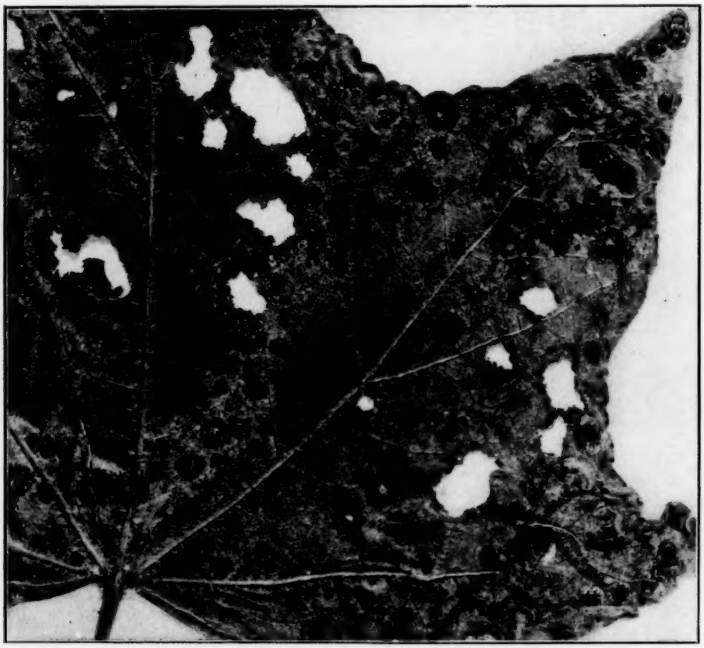

FIG. 1. Hollyhock rust caused by *Puccinia heterospora,* typical sori.

which are attacked by *Puccinia heterospora,* but not the hollyhock. In Texas, the writers have previously found *Puccinia heterospora* on different species of *Sida.* However, despite the senior writer's

[3] The writers are indebted to Dr. H. S. Jackson and Dr. F. D. Kern for confirming the identification of this fungus.

[4] Arthur, J. C. Uredinales of Porto Rico based on collections by F. L. Stevens. Mycologia **7**: 238–239. 1915.

[5] Seymour, A. B. Host index of the fungi of North America. Harvard University Press, Cambridge, Massachusetts. 1929.

continued interest in hollyhock diseases and frequent observations on hollyhock plants in different parts of the State, no rust had been found previously on hollyhocks. It therefore seems probable that the sudden outbreak of this rust on hollyhocks may be due to the appearance of a new physiologic form of the fungus.

Four normal hollyhock plants, growing in the garden of the senior writer at College Station, were used for inoculations during May, 1932. Two plants were sprayed with a heavy suspension

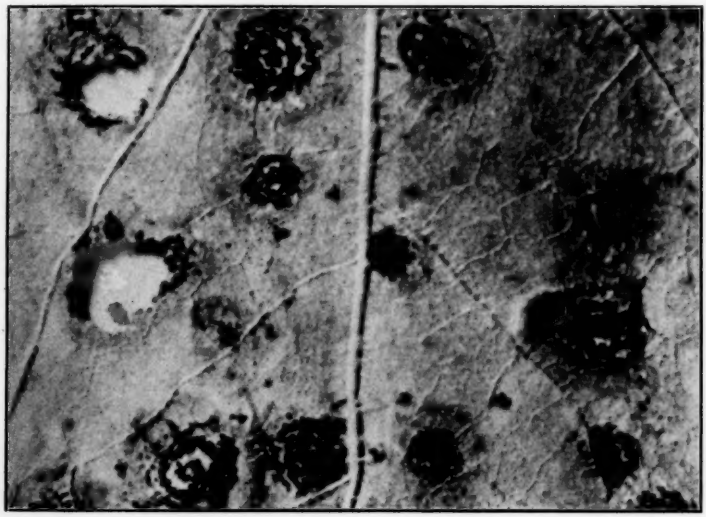

FIG. 2. Same as fig. 1 but enlarged about four times.

of sporidia washed from pustules on infected hollyhock leaves secured from Goliad, Texas, and two plants were inoculated by placing freshly-infected leaves from the same source in contact with the leaves of the plants to be inoculated. The plants were watered copiously and covered for 24 hours with bell jars lined with moist filter paper. Within three weeks, numerous typical rust pustules developed on all these inoculated plants. Four hollyhock plants growing on the other side of the house had been left as checks, and remained free from the rust. Under the microscope, the teliospores from the sori of the artificially inoculated

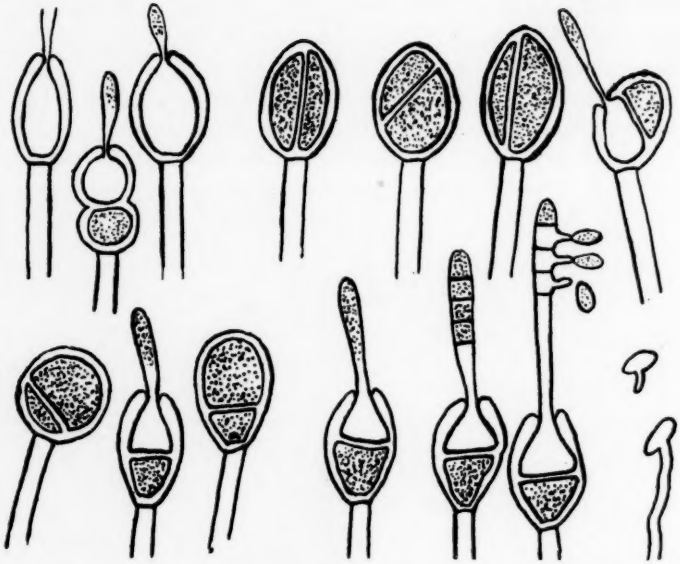

FIG. 3. One- and two-celled teleutospores of *P. heterospora*, some of these in various stages of germination.

plants appeared typical of *Puccinia heterospora*. These inoculations proved definitely that the autoecious rust, *Puccinia heterospora*, can attack hollyhocks.

COLLEGE STATION,
TEXAS.

INOPERCULATE CHYTRIDIACEOUS ORGANISMS COLLECTED IN THE VICINITY OF ITHACA, N. Y., WITH NOTES ON OTHER AQUATIC FUNGI

F. K. Sparrow, Jr.

(WITH PLATE 49 AND 1 TEXT FIGURE)

An account has been given in a previous paper (**8**) of the operculate members of the Chytridiales collected in the vicinity of Cornell University in 1931–32. The present one enumerates those members of this order found in the same region, which discharge their zoöspores after the deliquescence of one or more papillae. Notes on other aquatic fungi, including two operculate chytrids, collected in the vicinity of Ithaca, are also included.

In assembling the chytridiaceous fungi on the common character of their method of sporangial dehiscence, no relationship between them is implied. It is possible that the operculate or inoperculate character may be found to be a matter of some significance among certain families, but in the light of our present knowledge, it cannot be generally applied.

FUNGI COLLECTED

Inoperculate Chytrids

1. ? Plasmophagus Œdogoniorum de Wildeman, Ann. Soc. Belge Micro. **19**: 219. 1895. Parasitic in *Tribonema bombycinum*, Fall Creek, Forest Home; April, 1932.

The fungus, which consists of a single-celled, sac-like structure, 20–23 μ long by 8–11 μ in diameter, almost completely fills the abnormally swollen and elongated algal cell (TEXT FIG. 1, 1). The walls of the fungus are, however, distinct from those of the host. At maturity, the fungous protoplasm is divided into a large number of zoöspores. The latter are discharged upon the deliquescence of a single papilla formed on the sporangium, which protrudes through the wall of the host. The zoöspores are posteriorly uni-

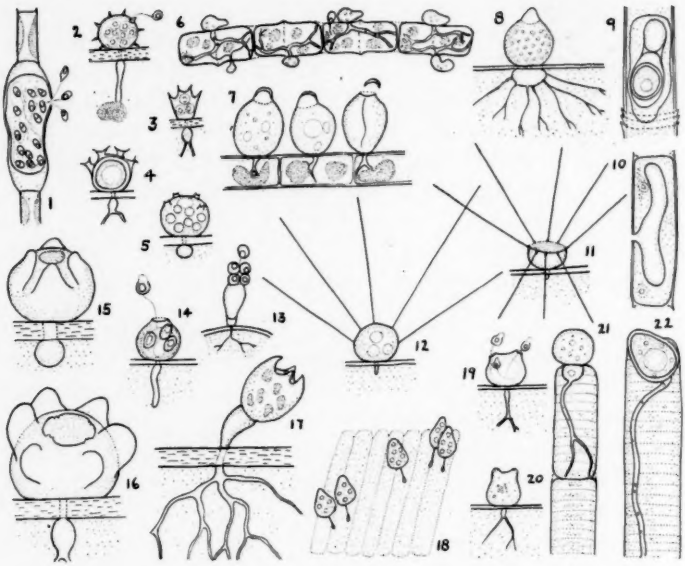

FIG. 1. 1. *? Plasmophagus Œdogoniorum*, discharging sporangium in a hypertrophied cell of *Tribonema*; × 600. 2. *Phlyctidium spinulosum* n. sp., discharging sporangium on *Cladophora*; × 600. 3. *? Phlyctochytrium* sp. on *Cladophora*; × 600. 4. *P. quadricorne*, resting spore, on *Cladophora*; × 375. 5. *P. Zygnematis*, mature sporangium on *Cladophora*; × 375. 6. Chytrid parasitic on *Melosira*; × 375. 7. *Chytridium papillatum* n. sp., immature and discharged sporangia on a filament of *Stigeoclonium*; × 760. 8. Chytrid parasitic on *Spirogyra*; × 375. 9. *Olpidiopsis Œdogoniorum*, resting spore and companion cell in *Œdogonium*; × 375. 10. *O. Œdogoniorum*, empty sporangium in cell of *Œdogonium*; × 375. 11. *Chytridium chaetophilum*, discharged sporangium on *Œdogonium*; × 760. 12. *C. chaetophilum*, undischarged sporangium on same host; × 760. 13. *Podochytrium clavatum*, discharging sporangium on *Navicula*; × 600. 14. *Phlyctidium Olla* n. sp., discharging sporangium on *Spirogyra*; × 375. 15, 16. *Phlyctochytrium* sp., discharged sporangia, on *Cladophora*; × 692. 17. Partially discharged sporangium of a chytrid on *Cladophora*; × 375. 18. Chytrid parasitic on *Tabellaria*; × 600. 19. *Phlyctochytrium biporosum*, discharging sporangium on *Spirogyra*; the branches of the rhizoidal system were only visible after tearing away the chloroplast of the host; × 375. 20. *P. biporosum*, immature sporangium on same host, showing a rhizoidal system of a somewhat different nature; × 375. 21. Chytrid parasitic on *Oscillatoria*; × 375. 22. Resting spores of a chytrid found on the same host; × 375.

ciliate, somewhat elongate, uniguttulate, and about 3 μ long by 2 μ in diameter. Further phases of the life history were not observed.

The organism resembles both *Olpidium* and *Pleolpidium* in the possession of an intramatrical, sac-like sporangium, without rhizoids, from which posteriorly uniciliate zoöspores emerge upon the deliquescence of a papilla. It further resembles *Pleolpidium* in its tendency to produce a marked hypertrophy of the infected host cell. However, it differs from this genus in that the walls of both host and parasite are distinct, not fused. *Plasmophagus* is scarcely, if at all, distinct from *Olpidium*, when one considers all the species of the latter genus. The chief points of difference, namely, that the thallus of *Plasmophagus* nearly completely fills the host cell, that it lacks a tube of discharge, and that it causes hypertrophy of the infected cell, are all exhibited by one or another undoubted species of *Olpidium*.

The writer is not convinced that the Ithacan fungus and that found by de Wildeman in France on *Œdogonium* are identical. However, in view of the lack of measurements of the type species and the scarcity of material in the present instance which precluded the possibility of cross-inoculation experiments, it has seemed best to refer the parasite of *Tribonema*, at least tentatively, to *P. Œdogoniorum*.

2. OLPIDIUM ENTOPHYTUM A. Braun, Monatsb. Berlin Akad. **1856**: 589. Parasitic in the vegetative cells of *Spirogyra* sp. (?), Fall Creek, Beebe Lake; Oct. 1931.
3. WORONINA POLYCYSTIS Cornu, Ann. Sci. Nat. V. **15**: 176. 1872. Parasitizing hyphae of *Achlya* spp. (?) growing on twigs; Slaterville Springs; Nov. 1931.
4. ? PSEUDOLPIDIUM INCRASSATA (Cornu) Fischer; Rabenh. Krypt.-Fl. 1[4]: 37. 1892. Parasitic in vegetative hyphae of *Achlya* sp., from soil at base of a liverwort; Cascadilla Gorge, Ithaca; August, 1931. Only the ellipsoid resting spores with their hyaline, undulating outer wall were observed.
5. OLPIDIOPSIS SAPROLEGNIAE, Cornu, l. c. p. 145. Parasitic in hyphae of *Achlya* spp., Fall Creek, Forest Home; August, 1931.

6. O. ŒDOGONIORUM (de Wild.) Scherffel, Arch. Prot. **52**: 108. 1925. In filaments of *Œdogonium* sp., Beebe Lake; Oct., 1931. The elongate, sac-like discharged sporangia, 50 μ long by 5–7 μ in diameter, each with a short, lateral exit tube were found in the host cells (TEXT FIG. 1, 10). Often in the same cells, associated with the sporangia were elliptical resting spores, 13 μ long by 10 μ in diameter. Each thick-walled spore possessed a nearly spherical companion cell, about 10 μ in diameter, adhering to its somewhat larger "oögonium" (TEXT FIG. 1, 9). No zoöspores were observed but according to Scherffel, these are biciliate.

7. **Phlyctidium spinulosum** sp. nov. Sporangium extramatrical, sessile, spherical or slightly ovoid, colorless, generally about 10 μ in diameter, covered with short, sharp spines 2 μ high; with a single, unbranched, slightly inflated rhizoid, 10 μ long by 3 μ in diameter; with a single, sub-apical pore through which the spherical, posteriorly uniciliate, uniguttulate zoöspores (usually about 8 in number), 3 μ in diameter, escape. Resting spores not observed.

Parasitic in *Cladophora* sp., Fall Creek, Forest Home; Nov., 1931. Rare, occurring with *Phlyctochytrium quadricorne* (de Bary) Schröt.

Zoosporangiis globosis v. sub-globosis sessilibus, 10 μ dia., tunica spinulosa, basi filamentis inflatis irramosis munitis; zoosporis (circ. 8) globosis, 1-ciliatis, uniguttulatis, 3 μ dia.; papilla sub apicale praeditis. Sporis perdurantibus ignotis.

Hab. in *Cladophora* sp., Ithaca, N. Y.

This is the only species of the genus (TEXT FIG. 1, 2) which does not possess a smooth-walled sporangium.

8. **Phlyctidium anatropum** (Braun) comb. nov.

Syn. *Chytridium anatropum* Braun, Monatsb. Berl. Akad. **1856**: 588.

Rhizophidium anatropum (Braun) Fischer, l. c. p. 104.

The broadly pyriform, smooth-walled, strongly arched, or reflexed sporangia, 15–20 μ long by 5–7 μ in diameter, were attached to the host near their narrower end by a short, lateral, barely perceptible, knob-like, intramatrical peg (PLATE 49, FIGS. 4–7).

Emergence of the zoöspores seemingly took place through one, sometimes two pores, at either or both ends of the sporangium (PLATE 49, FIGS. 4, 6). In spite of intermittent observations for more than two months on sporangia, no cases of actual discharge of the zoöspores were observed. The latter were frequently seen, however, fully formed within the sporangia (PLATE 49, FIG. 8). They were spherical, 3–4 μ in diameter, and, in contrast to those found in inactive sporangia of other chytrids, did not seem to possess the usual prominent oil globules. In the many discharged and undischarged sporangia examined, no traces of an operculum attached to or lying in the immediate vicinity of a sporangium were observed. These nearly always can be found near plants of operculate species. There seems little doubt therefore, that the zoöspores are discharged in an inoperculate manner. Thick-walled, ovoid, extramatrical resting spores were described by Braun, but they were not observed in the present material.

This curious fungus was described but not figured by Braun, who found it on *Chaetophora*. It was later (1858) mentioned by Schenk (**4**) as parasitizing *Oscillatoria*. Since then the chytrid has apparently remained unobserved and no figures of it have apparently been heretofore published. From its intramatrical attachment, unobserved by Braun and Schenk, the fungus appears to be better placed, for the present, in *Phlyctidium* than in *Rhizophidium*.

The algal host seemed to be entirely unaffected by the presence of the fungus.

On *Stigeoclonium* sp., Bessemer, N. Y.; Jan. 1932.

9. **Phlyctidium Olla** sp. nov. Sporangium sessile, urn-shaped, smooth-walled, 13–15 μ high by 15–17 μ in diameter, with a broad apical papilla; intramatrical portion unbranched, inflated, about 2 μ in diameter by about 12 μ long; zoöspores emerging after the deliquescence of the papilla, ovoid, 5 μ long by 3 μ in diameter, posteriorly uniciliate, uniguttulate. Resting spores not observed.

Parasitic in *Spirogyra* sp., Beebe Lake, Ithaca; Nov. 1931.

Zoosporangiis sessilibus ampullaceis, 13–15 $\times$ 15–17 μ, basi filamentis inflatis irramosis munitis; zoosporis ovoideis, 5 $\times$ 3 μ, uniciliatis, uniguttulatis. Sporis perdurantibus ignotis.

Hab. in *Spirogyra* sp., Ithaca, N. Y.

In the shape of the sporangium this fungus (TEXT FIG. 1, 14) resembles *Rhizophidium sphaerocarpum* (Zopf) Fischer. However, the inflated character of the intramatrical system distinguishes it as a species of *Phlyctidium*. From other species of this genus the Ithacan fungus is also distinct. In the shape of its sporangium it approximates that found in *P. Chlorogonii* Serb., *Phlyctidium Eudorinae* Gim. (a species probably identical with Serbinow's fungus), and to a lesser extent, the incompletely known *P. Bumilleriae* Couch. All of these species, however, possess a bulbous or discoid intramatrical portion. Other species of *Phlyctidium* also possess well-marked characters which make them distinct from the form under consideration. The spherical or ellipsoidal sporangia of *P. laterale* possess one or more lateral papillae of discharge; those of *P. breviceps* (Atk.) Minden are attached to the host by a short, peg-like structure; the finger-like sporangia of *P. anomalum* Couch are attached to the host by a bulbous or discoid base. The two species of *Phlyctidium* previously discussed in this paper also exhibit individuality, *P. spinulosum*, by the character of its wall, and *P. anatropum*, by the shape of its sporangium.

Attention might be called to what is possibly another species of *Phlyctidium*, distinct from all others by the possession, on the surface of its spherical sporangium, which was about 15 μ in diameter, of a series of very tenuous, radiating hairs (PLATE 49, FIG. 12). The intramatrical portion of the fungus consisted of a stout, somewhat irregular, unbranched filament, slightly swollen at the point of contact of the inner wall of the host. This "haustorium" was about 40 μ long by 8 μ in diameter. No further phases of the organism, which was parasitic in a species of *Cladophora* collected in Beebe Lake in October, 1931, were observed. The nature of the intramatrical portion of this fungus which, because of its slight sub-sporangial swelling resembles a species of *Phlyctochytrium*, and because of the unbranched, inflated character of the remainder is *Phlyctidium*-like, well illustrates (as do *Phlyctochytrium biporosum*, *P. vernale*, and others) the rather dubious nature of the characters which at present separate *Phlyctidium* and *Phlyctochytrium* from *Rhizophidium*.

10. RHIZOPHIDIUM GLOBOSUM (Br.) Schröt. Krypt.-Fl. Schles. **3**[1]: 191. Parasitic in *Oscillatoria* spp., *Spirogyra* spp., Fall Creek, Forest Home; Aug.–Dec. 1931; *Navicula* sp., Lloyd Reservation; Nov., 1931.
11. RHIZOPHIDIUM CARPOPHILUM (Zopf) Fischer, l. c. p. 95. Resting spores and sporangia abundant in old water cultures, on oögonia and oöspores of *Saprolegnia* sp., *Achlya* spp. and *Monoblepharis macranda;* Fall Creek, Forest Home; Nov.–April, 1931–2.
12. RHIZOPHIDIUM SPHAEROCARPUM (Zopf) Fischer, l. c. p. 95. On nematodes parasitized by *Harposporium*; Beebe Lake; March, 1932. The sporangia of this fungus, which the writer cannot distinguish morphologically from those found on Green Algae by Zopf, were spherical to urn-shaped, 17–20 μ in diameter, with a broad apical papilla and a slender, unbranched, intramatrical rhizoid. The zoöspores, which were about 4 μ in diameter, were discharged from the sporangium *en masse,* through a broad terminal pore, and were apparently imbedded in "slime" or surrounded by a vesicle (PLATE 49, FIG. 1). Ultimately, the mass became disorganized and the motionless spores, thus liberated, gradually became motile.
13. RHIZOPHIDIUM FUSUS (Zopf) Fischer, l. c. p. 99. Very common on *Melosira varians,* Fall Creek, Forest Home; at all times of the year.
14. RHIZOPHIDIUM GIBBOSUM (Zopf) Fischer, l. c. p. 102. Parasitizing *Navicula* sp., Bessemer, N. Y.; March, 1932. Only the peculiar, contorted, irregular sporangia, 30–45 μ long by 10–20 μ in diameter, were observed (PLATE 49, FIG. 13). According to Zopf, these possess an intramatrical rhizoidal system. The empty sporangium on the diatom shown on plate 49, fig. 13, is that of an undetermined chytrid.
15. RHIZOPHIDIUM SIMPLEX (Dang.) Fischer, l. c. p. 101. On dead colonies of *Pandorina,* Bessemer, N. Y.; March, 1932.
16. RHIZOPHIDIUM POLLINIS (Br.) Zopf, Abhandl. naturf. Gesell. Halle **17**: 82. 1887. On pollen of *Pinus* used as "bait," Beebe Lake; Dec., 1931.

17. RHIZOPHIDIUM sp. Parasitizing *Spirogyra* sp., Bessemer, N. Y.; March, 1932.

The sporangia of this fungus were somewhat similar in shape to those of *R. sphaerocarpum,* but in contrast to that species possessed a smaller apical papilla (PLATE 49, FIG. 18). In its general aspect it also resembled the incompletely known *R. dubium* de Wild. One characteristic feature was the formation at the base of the sporangium at the point of attachment of the well-developed, ramifying rhizoidal system, of a conspicuous, glistening nodule. This body probably separated the intra- and extramatrical parts of the plant.

The behavior of the zoöspores of this organism is of unusual interest. These bodies, which were 4–5 μ in diameter, spherical, and of the usual chytridiaceous, uniguttulate type, upon being discharged from the sporangium after the deliquescence of a single apical papilla, swarmed for several hours and then settled down on the wall of the *Spirogyra* in compact groups of 4–10 or more (PLATE 49, FIG. 20). Occasionally they occurred in groups of two or three and in these cases their subsequent development was followed with greater clarity.

Two adjacent spores of the same size, each produced upon germination the usual germ tube which penetrated the wall of the host and formed within, an intramatrical rhizoidal system of limited extent (PLATE 49, FIG. 16). It was soon evident, however, that one of these spores was increasing rapidly in size, whereas the other had apparently ceased to grow (PLATE 49, FIG. 15). The rhizoidal system of the larger plant continued to increase in stoutness and extent, while that of the smaller remained relatively undeveloped. Under favorable conditions for observation with a water immersion objective, there could be observed, within the larger thallus at the point of contact of the two plants a very definite, short, refractive tube which was seemingly formed by the smaller plant (PLATE 49, FIGS. 17, 22). The whole content of the smaller thallus which may be spoken of arbitrarily as the "male plant," was, with the exception of a single globule, discharged through this tube into the larger thallus. The receptive plant continued to increase in size and ultimately its extramatrical part became transformed into a thick-walled resting spore to

which the empty cyst of the male thallus—generally torn from its rhizoidal system—remained adherent (PLATE 49, FIGS. 15, 21). When mature, the resting spore was spherical or ellipsoidal, thick-walled, 11–14 μ in diameter, with a large oil globule in the content, and often surrounded by an outer, irregular, dark-brown incrustation, 1–3 μ thick. The adherent male cell was constantly 5 μ in diameter, colorless and smooth walled. Germination of the resting spores was not observed.

Because of the limited amount of material available, the above account is of necessity somewhat brief and incomplete. It is clear, however, that in the formation of the resting spore there is a definite process of fertilization which involves a transportation of material by means of a tube from one thallus to another. Furthermore the zoöspores from which these two thalli were derived were indistinguishable from one another. In one instance, tubes of considerable length, similar to those found in *Zygorhizidium Willei* Löwenth. were observed on a few thalli (PLATE 49, FIG. 19). No further development took place in this instance.

That this conjugation of thalli is the only method whereby resting spores of *Rhizophidium* are formed does not, from the present state of our knowledge, appear probable. Extramatrical, thick-walled resting spores without adherent male cells, associated with sporangia of *Rhizophidium* have been known and frequently observed since Braun's time. They have been found many times by the writer. Whether or not this type of spore is simply a modified sporangium or a body formed after the copulation of planogametes, is not known. Zopf (l. c.) was unable to detect any evidence of such copulation in *R. pollinis*, a species in which such resting spores are formed in abundance. Seemingly, however, no serious effort has been made since then to verify this statement.

If only one species of fungus has been involved in each of the cases where resting spores have been reported in *Rhizophidium*, it is evident that in this genus we have either different types of resting spores, sexual and asexual in origin, or different processes of sexual reproduction which lead to their formation.

Scherffel (**5**) has described resting spores which closely resemble those of the present fungus. These, he conjectured, might belong to *Chytridium Confervae* (Willie) Minden, the non-sexual stage

of which he found on the same host (*Tribonema*). This same investigator has recorded other instances of chytridiaceous resting spores formed by a process of conjugation of thalli, and in one species, *Rhizophidium goniosporum* Scherf., the present writer is able to confirm his observations from material recently collected in Great Britain. More recently, Couch (**2**) has described in *Rhizophidium* sexually formed resting spores essentially like those of the present fungus, with which it may be identical. The sporangium of the Carolinian form was, however, multiporous. The finding of such resting spores in a "*Rhizophidium globosum*" type of chytrid is of unusual interest, for it is in this multiporous type that resting spores without companion cells have been most frequently found.

As the literature on the genus *Rhizophidium* is rather extensive and in the particular section to which the fungus under discussion belongs, in a chaotic state taxonomically, it has not been deemed desirable to refer the organism at this time to any described species.

18. PHLYCTOCHYTRIUM BIPOROSUM Couch, Jour. Elisha Mitchell Sci. Soc. **47**: 254. 1932. Parasitic in *Spirogyra* sp. (?), Bessemer, N. Y.; March, 1932.

The sporangia of this fungus were sessile, smooth-walled, ovoid at first, but upon the formation of the discharge papillae became truncated at the apex and angular in outline; they varied from 8–13 μ in diameter by 10–12 μ in height. The two pores were formed on the upper part of the sporangium and while they were usually sessile, occasionally they were borne on the tips of short, diverging beaks. Through these pores, minute, posteriorly uniciliate, uniguttulate zoöspores about 2 μ in diameter, crept in an amoeboid manner (TEXT FIG. 1, 19). The intramatrical portion of the fungus was a branched or frequently unbranched rhizoidal system (TEXT FIG. 1, 20), which, because of the density of the host chloroplast, was of unknown extent. Resting spores were not observed. Just beneath the wall of the host there was generally visible a slight swelling of the fungous rhizoid. This swelling was at most barely perceptible, and in some instances was lacking. Resting spores were not observed, nor have they been recorded by Couch.

This species is probably identical with that incompletely described by de Wildeman as "*Chytridium rostellatum*" (*Rhizo-*

phidium rostellatum (de Wild.) Fischer). However, it would seem better to adopt the name given to the more completely described fungus. As was pointed out in the discussion of *Phlyctidium Olla*, the three genera *Phlyctidium*, *Rhizophidium*, and *Phlyctochytrium* are in need of a more clear-cut delimitation of generic characteristics. It seems, at least to the writer, a mere "splitting of hairs" to place this form in *Phlyctochytrium*, rather than *Rhizophidium*. Further, from Couch's description and figures, his fungus might be equally well placed in *Phlyctidium*.

19. PHLYCTOCHYTRIUM ZYGNEMATIS (Rosen) Schröt. E. & P. Nat. Pfl. 1¹: 79. 1892. Parasitic on Cladophora sp., Beebe Lake; Oct., 1931. The nearly spherical, sessile sporangium, about 17 μ in diameter, possesses at its apex four inconspicuous, blunt, slightly notched teeth which surround the papilla of discharge. Within the host cell there is a spherical portion, about 7 μ in diameter, which is seemingly devoid of rhizoids (TEXT FIG. 1, 5). No further phases in the life history of the fungus were observed.
20. PHLYCTOCHYTRIUM QUADRICORNE (de Bary) Schröt. l. c. p. 79. Common on filaments of *Cladophora* in all aquatic habitats in the vicinity of Ithaca throughout the year. This species, which resembles the preceding one, but which possesses four, prominent, deeply incised teeth, the apices of which are strongly divergent, occurs in dense clusters on the algal filament. The intramatrical portion varies from fusiform to spherical in shape. Extramatrical, thick-walled resting bodies, 15 μ in diameter (TEXT FIG. 1, 4), were also observed and may possibly be the resting spores of this species.

Two other organisms, which apparently belong to the "Dentigera" group of the genus, were also observed on *Cladophora* in the vicinity of Ithaca. The first of these possessed somewhat cylindrical sporangia which tapered perceptibly towards the base (TEXT FIG. 1, 3), were 5–7 μ in diameter by 7 μ in height, and possessed four, plain, diverging teeth. The intramatrical system was rhizoidal in character and emanated from a swollen, subsporangial portion. The zoöspores, 3–4 in number, which even

in the undischarged sporangium appeared spherical and uniguttulate, were not more than 3 μ in diameter. The method of their discharge was not observed.

The second fungus was much larger and possessed broad, urn-shaped sporangia, 17–23 μ in diameter, on which were 4–6 coarse, solid, nodular or flange-like refractive outgrowths (TEXT FIG. 1, 15, 16). The intramatrical portion was pronouncedly spherical and the tube connecting it to the sporangium unusually stout. The zoöspores evidently escaped through the large circular, apical pore which was surrounded by the crown of nodules.

21. PODOCHYTRIUM CLAVATUM Pfitzer, Sitz. ber. Nieder-rh. Ges. Nat. **1870**: 62. Parasitizing *Navicula* spp., Fall Creek, Forest Home, and Lloyd Reservation; Oct. 1931.

The pyriform sporangia, 8–11 μ high by 5 μ in diameter, possessed a cup-like sterile base about 3 μ in diameter, which rested on the host (TEXT FIG. 1, 13). Within the latter, from the tip of a needle-like penetration tube, a delicate, branched rhizoidal system was formed. The zoöspores, 3 μ in diameter, posteriorly uniciliate and uniguttulate, at maturity emerged after the deliquescence of an apical papilla, and formed a compact motionless mass at the mouth of the sporangium. After a few seconds, the zoospores fell apart, initiated ciliary movement, and swam away. Motion of the spores before emergence from the sporangium could often be detected.

22. ENTOPHLYCTIS CIENKOWSKIANA (Zopf) Fischer, l. c. p. 118. Common on *Cladophora* spp., Ithaca, Forest Home; throughout the year.

23. HARPOCHYTRIUM INTERMEDIUM Atk. Ann. Myc. **1**: 500. 1903. On filaments of *Achlya*, growing on twigs collected in Fall Creek, Forest Home; April, 1932. This species has been recently found in abundance in the same habitat on twigs collected at Cambridge, Eng.

24. CLADOCHYTRIUM REPLICATUM Karling, Am. Jour. Bot. **18**: 526. 1931. Common on *Elodea* leaves, Fall Creek, Forest Home; Oct. 1931; also in decaying grass culms, Slaterville Springs; April, 1932.

In the material from Slaterville Springs, spiny resting spores, 15–17 μ in diameter, were found (PLATE 49, FIG. 3). Each possessed a somewhat thickened, colorless wall and within the contents a large, orange-brown oil globule. The surface of the spore was covered with slender, scarcely tapering spines, 5–7 μ in length. Repeated attempts to germinate these spores have thus far failed, but work is being continued on this point.

OPERCULATE CHYTRIDS

Three other operculate chytrids were encountered after the paper on this group of fungi collected in the vicinity of Ithaca had gone to press.

25. **Chytridium papillatum** sp. nov. Sporangium sessile, pyriform to lemon-shaped, smooth-walled, 10–11 μ high by 7–8 μ in diameter, with a prominent broad, apical papilla surmounted by a convex operculum; with a delicate, sparsely branched rhizoidal system of limited extent which arises from a stouter intramatrical sub-sporangial stalk; zoöspores posteriorly uniciliate, uniguttulate, about 3–4 μ in diameter. Resting spores not observed. Occurring in groups along filaments of *Stigeoclonium* sp., Bessemer, N. Y.; March, 1932.

In the shape of its sporangium and nature of its rhizoidal system (TEXT FIG. 1, *7*), the organism is exactly similar to *Rhizophidium mamillatum* (Br.) Fischer. However, from the accounts of Braun, Sorokin, Dangeard (as *Chytridium assymmetricum*) and Couch, the last named fungus seems to possess an inoperculate method of zoöspore discharge. *Chytridium minus* Lacoste & Suring, while resembling the present organism in the shape of its sporangium, possesses, from the figures given, a peculiar, flat-topped papilla. As no account of zoöspore discharge is given, further comparison is impossible. All other species of the genus are unlike the present fungus in the shape of the sporangium and nature of the rhizoidal system. Whether or not the similar-appearing fungus found by Pringsheim (reported by Braun) on *Stigeoclonium* was a *Chytridium* or a *Rhizophidium* cannot now be determined as no discharge of the zoöspores was observed.

Zoosporangiis sessilibus pyriformibus vel limoniformibus, 10–11 × 7–8 μ, apice umbonatis, operculo dehiscentibus; parte subsporangiale crassa rhizoideis paucis sparse ramosis praeditis; zoosporis 1-ciliatis, uniguttulatis circ. 3–4 μ dia. Sporis perdurantibus ignotis.

Hab. in *Stigeoclonium* sp., Bessemer, N. Y.

26. CHYTRIDIUM CHAETOPHILUM Scherffel, Arch. Prot. **53**: 45. 1925. Syn. *Rhizophidium von Mindenii* Valkanov, Arch. Prot. **73**: 363. 1931.

The extramatrical, sessile, spherical sporangia, 8–10 μ in diameter, are covered by very long setae (TEXT FIG. 1, 12). The intramatrical portion of the fungus consists of a short peg which barely penetrates the host cell. The latter, in most cases, seems unaffected by the presence of the adherent organism. Occasionally, empty sporangia are seen, the whole upper half of which has dehisced (TEXT FIG. 1, 11). Whether this type of dehiscence can be considered comparable to that found in other species of the genus, the writer is at present not prepared to state. It may possibly be only a disintegration of the wall material. Scherffel, who saw the discharge of the zoöspores, states that in addition to a splitting of the wall of the sporangium, the zoöspores may be set free by a gelatinization of a basal part of the sporangium. Extramatrical resting spores 7–10 μ diameter, exactly similar to the sporangia but with a pronouncedly thickened wall, were occasionally observed in the present material. Scherffel has described extramatrical ones provided with short setae and a companion cell as typical for the species. The type found associated with the present fungus he has described as *Rhizophidium setigerum* Scherf.

It is possible that *C. chaetophilum* may be referable in the future to the genus *Rhizophidium*. The form described by Valkanov as *Rhizophidium von Mindenii* is without doubt identical with Scherffel's fungus.

27. **Chytridium perniciosum** sp. nov. Sporangium extramatrical, sessile, smooth walled, spherical at first, becoming broadly pyriform, with a prominent apical, solid operculum which, upon discharge of the zoöspores remains attached to the sporangium and often falls back into place, covering the orifice (PLATE 49, FIG. 9); 10–16 μ high by 12–23 μ in

diameter; zoöspores spherical, posteriorly unicilate, uniguttulate, 3–4 μ in diameter; intramatrical portion a system of stout, branching rhizoids. Resting spores spherical, intramatrical, with a smooth, somewhat thickened wall, and one or more large oil globules (PLATE 49, FIG. 10); 11–16 μ in diameter.

Parasitic on *Navicula* sp., Bessemer, N. Y.; March, 1932.

Zoosporangiis sessilibus primo globosis dein valde piriformibus, 10–16 $\mu \times$ 12–23 μ, basi filamentis ramosis, apici operculo solido adherente praeditis; zoosporis globosis 1-ciliatis uniguttulatis 3–4 μ dia. Sporis perdurantibus globosis, membrana crassa, uni- vel multiguttulatis, 11–16 μ dia.

Hab. in *Navicula* sp., Bessemer, N. Y.

Occasionally large sporangia, about 30 μ high by 35 μ in diameter, were observed. Other sporangia, ovoid, pyriform or irregular in shape, with very thick walls and a horn-like operculum were also found (PLATE 49, FIG. 11). These may possibly be abnormal specimens of *C. perniciosum*. It might be noted that the fungus was an extremely virulent parasite and destroyed within a few days nearly all of the diatoms present in the dish. After being attacked by the fungus, the chloroplasts of the alga rapidly became discolored and dessicated. In immature sporangia, the operculum often appeared invaginated. Such a condition has also been observed in *Nowakowskiella*.

Chytridium perniciosum appears to be distinct from other undoubted members of the genus which possess somewhat similarly shaped sporangia. *C. sphaerocarpum* Dang. and *C. inflatum* Spar., both possess a thin-walled operculum; they further differ from *C. perniciosum* in the nature of their intramatrical system, that of the first-named being delicate and sparsely branched, the second, inflated in character. *Chytridium Olla* Br., *C. breviceps* Br. and *C. acuminatum*[1] (possibly a small form of *C. Olla*) all possess an urn-shaped sporangium and a strongly umbonate operculum. *Chytridium pyriforme* Reinsch, has pyriform sporangia which, in

[1] Scherffel (**6**) has redefined this species to include a form with urn-shaped sporangia, umbonate operculum, and a spherical, intramatrical base. Braun, however, in his original description of *C. breviceps*, states that it differs from *C. Olla* in its smaller size and in the possession of a "sehr kurzen rundlichen Wurzelfuss. . . ." It is probable, therefore, that Scherffel's fungus, termed *C. acuminatum*, is closer to *C. breviceps*.

contrast to those of *C. perniciosum,* taper towards the base. The empty, broadly urn-shaped, wide-mouthed sporangium of *C. lateoperculatum* Scherf. possesses too broad an exit pore and too flat an operculum to be confused with the present fungus. Further, the pyriform, operculate sporangia, with a short tube of discharge, found by Scherffel in decaying leaves of *Typha,* and referred by him to *Chytridium* (*Rhizophidium*) *xylophilum* Cornu, almost certainly belong to *Nowakowskiella elegans* (Now.) Schröt., a fungus very commonly found in such a habitat. However, as no rhizoidal system was observed, the identity of this particular organism must remain somewhat doubtful.

CHYTRIDS OF DOUBTFUL AFFINITIES

In addition to the aforementioned forms, several chytridiaceous fungi were found in the region, which could not be identified, as certain critical points in their life history were not observed.

A very small parasite of *Tabellaria,* possessing pyriform sporangia, 7 μ long by 5 μ in diameter, and a short slender extramatrical stalk which terminated in a refractive, intramatrical granule, was found in Fall Creek at Forest Home, in October, 1931 (TEXT FIG. 1, 18). Four to six uniguttulate zoöspores, about 3–4 μ in diameter, were found in each sporangium, but the method of their discharge was not observed.

Filaments of *Oscillatoria* sp., collected in the same creek in October, 1931, were, after several weeks in the laboratory, parasitized by a chytridiaceous fungus, the sporangia of which were extramatrical, spherical, about 12 μ in diameter, and possessed a sub-sporangial, intramatrical, spherical swelling about 6 μ in diameter. The sporangium rested on the terminal cell of the algal filament (TEXT FIG. 1, 21). Within the *Oscillatoria* a stout, sparingly branched rhizoidal system was found, which penetrated a considerable number of cells of the host. The contents of the latter became grey and disorganized upon the incursion of the fungus. Pyriform, thick-walled, seemingly intramatrical resting spores, 18 μ long by 8–16 μ in diameter (TEXT FIG. 1, 22) were found in the same lot of material and may possibly belong to the organism previously described.

On filaments of *Melosira varians,* collected in Fall Creek in August, 1931, another virulently parasitic chytrid was observed.

The sporangia were pyriform, 3–5 μ high by 7–10 μ in diameter, the long axes being parallel with that of the algal filament (TEXT FIG. 1, 6). Within the host cell a relatively stout, branched system of rhizoids was formed by the fungus. The latter caused discoloration and disintegration of the *Melosira* chloroplasts.

Another chytrid, possibly identical with *Rhizophidium digitatum* Scherf., was observed on a filament of *Cladophora* from Beebe Lake, collected in November, 1931. The broadly oval sporangium, 20 μ long by 7–10 μ in diameter, possessed a crown of four, coarse, plain, hollow teeth. The sporangium was not sessile but was borne on an inflated, extramatrical filament which was contiguous with an intramatrical, stout, ramifying rhizoidal system (TEXT FIG. 1, 17). The contents of the sporangium which were apparently dead, bore evidences of zoöspore initials. The circular exit pore was clearly visible within the crown of teeth. As no other plants were found, nothing further could be determined about the fungus. Plants with extramatrical, subsporangial portions have been figured by Rosen in the cases of *Phlyctochytrium Zygnematis* and *P. dentatum,* and by Scherffel for *Rhizophidium digitatum.*

A fifth chytrid of doubtful affinities was observed in *Spirogyra,* collected at Slaterville, N. Y., in March, 1932. The extramatrical sporangia were broadly ovoid, symmetrical, 10–11 μ in diameter by 10–20 μ high, and possessed a broad, prominent, apical papilla. Within the host cell a sub-spherical, somewhat flattened swelling, 5–10 μ in diameter, was formed, from the whole surface of which numerous branched rhizoids emanated (TEXT FIG. 1, 8). No further points in the life history were observed.

OTHER AQUATIC FUNGI COLLECTED

BLASTOCLADIALES

28. BLASTOCLADIA PRINGSHEIMII Reinsch, Jahrb. Wiss. Bot. **11**: 291. 1878. Very common on submerged apples and twigs, Fall Creek, Forest Home; pool on golf course; Lloyd Reservation; throughout the year.

29. BLASTOCLADIA GLOBOSA Kanouse, Am. Jour. Bot. **14**: 298. 1927. On submerged apples, occurring with the previous species. In contrast to *B. Pringsheimii,* this species forms minute pustules on the surface of the fruit.

MONOBLEPHARIDALES

30. MONOBLEPHARIS SPHAERICA Cornu, Bull. Soc. Bot. Fr. **18**: 59. 1871; Ann. Sci. Nat. V. **15**: 82. 1872. On twigs of all types, Fall Creek, Forest Home, throughout the year. A more extensive account of this and other species of the order collected in the vicinity of Ithaca and elsewhere has been given in a recent paper by the writer (**9**).

31. MONOBLEPHARIS POLYMORPHA Cornu, l. c. 1871 p. 59; l. c. 1872, p. 83. Common on twigs of various types, Fall Creek, Beebe Lake; throughout the year.

32. MONOBLEPHARIS MACRANDRA (Lagerh.) Woronin, Mém. Acad. Imp. Sci. St. Pet. VIII. **16**: 13. 1904. Occurring with *M. sphaerica.*

33. MONOBLEPHARIS MACRANDRA var. LAEVIS Spar. Ann. Bot. **47**: 531. 1933. On fruits of *Rosa* sp., Fall Creek; April, 1932.

34. MONOBLEPHARIS REGIGNENS Lagerh. Bihand till Sv. Vet. Akad. Handl. **25**[a]: 39. 1900. On twigs of various types, vicinity of Ithaca; throughout the year.

35. MONOBLEPHARIS OVIGERA Lagerh. l. c. p. 39. On twigs, occurring with the previous species.

36. GONAPODYA PROLIFERA (Cornu) Fischer, l. c. p. 382. Very common on submerged fruits and twigs, Fall Creek; Lloyd Reservation; throughout the year.

37. GONAPODYA POLYMORPHA Thaxter, Bot. Gaz. **20**: 481. 1895. Occurring with the previous species, but more commonly on twigs.

SAPROLEGNIALES

38. APHANOMYCOPSIS BACILLARIACEARUM Scherffel, Arch. Prot. **52**: 14. 1925. Parasitic in *Pinnularia* sp., Fall Creek, Forest Home; Oct., 1931.

This organism has recently been described from Hungary by Scherffel. The Ithacan fungus consisted of a simple, slightly inflated, unbranched, intramatrical tube, 6–8 μ in diameter, and a slightly narrower evacuation tube, 10–20 μ long. At the orifice of the latter were clustered 5–6 cystospores, 10 μ in diameter. Where the evacuation tube passed between the two valves of the

diatom, its walls were considerably thickened (PLATE 49, FIG. 14). This structure has been termed the "Spreizapparatus" by Scherffel, and is formed by other filamentous Phycomycetes which inhabit diatoms.

Emergence of a laterally biciliate zoöspore from each of the cystospores has been noted by Scherffel. Although it was not observed in the present material there is no reason to suppose that it is lacking. The secondary zoöspores observed by Scherffel were 10–12 μ long by 7–8 μ in diameter. Branching of the thallus and an intramatrical oögonium with one or two apandrous, saprolegniaceous oöspores were also observed by Scherffel.

The genus is said to differ from *Aphanomyces* " . . . durch das Fehlen eines differenzierten Zoosporangiums und durch das rudimentäre, mehreiige Oogonium."

39. ECTROGELLA BACILLARIACEARUM Zopf, Nova Acta Leop-Carol Akad. **47**: 175, Amend. Scherffel (l. c.). In *Pinnularia* sp., Fall Creek, Forest Home; Oct., 1931.

40. ECTROGELLA MONOSTOMA Scherffel, l. c. p. 8. 1925. In *Pinnularia* sp., Fall Creek, Forest Home; Oct., 1931. The broad thallus of this fungus, with a single tube of discharge, was found occurring in the some lot of material with the previous species. In neither case was the evacuation of the cysts of the primary spores observed.

It will be recalled that Zopf figured posteriorly uniciliate zoöspores as typical for *Ectrogella*. Scherffel has figured, in what all other respects is a fungus similar to Zopf's *E. bacillariacearum*, laterally biciliate zoöspores emerging from the primary cysts. The same type of discharge has been noted by him in *E. monostoma* and several other species assigned to the genus. This change in the concept of *Ectrogella* has shifted it from the Chytridiales to the Saprolegniales where, if Scherffel's observations are supported by further investigation, it undoubtedly belongs.

41. APHANOMYCES EXOPARASITICUS Couch, Jour. Elisha Mitchell Sci. Soc. **41**: 213. 1926. Parasitizing filaments of *Achlya* sp., growing on twigs collected at Slaterville Springs; March, 1933.

42. APHANOMYCES PHYCOPHILUS de Bary, Jahrb. Wiss. Bot. **2**: 179. 1860. Parasitic on *Spirogyra* sp., Beebe Lake; Nov., 1931. The fungus previously described from *Nitella* by the writer (**7**) and assigned to this species, is too small and delicate to be identical with *A. phycophilus*. Further, the thin-walled, slender, sharp-pointed oögonial spines of the *Nitella* parasite are quite different in character from the thick-walled, blunt, rounded ones of the present species.
43. APHANOMYCES NORVEGICUS Wille, Skr. Vid.-Selsk. Christiania. **1899**[3]: 9. Occurring with the previous species.
44. SOMMERSTORFFIA SPINOSA Arn. Flora **116**: 109. 1923. Among filaments of *Cladophora*, together with *Zoöphagus insidians*, capturing various members of the *Rotiferae*. Fall Creek, Forest Home; Oct., 1931.
45. THRAUSTOTHECA CLAVATA (de Bary) Humphrey, Trans. Amer. Phil. Soc. **17**: 130. 1893. Common in soil, often occurring with *Nowakowskiella elegans*, Ithaca; throughout the year.

LEPTOMITALES

46. APODACHLYA[2] BRACHYNEMA (Hild.) Prings. Ber. Deutsch. Bot. Gesell. **1**: 289. 1883. Common on submerged apples, Fall Creek, Forest Home; Lloyd Reservation; throughout the year.
47. APODACHLYA PIRIFERA Zopf, Nova Acta. Leop.-Carol **52**: 362. 1888. On submerged Birch twigs, Arnott Forest, August, 1931.
48. RHIPIDIUM AMERICANUM Thaxter, Bot. Gaz. **21**: 327. 1896. Common on submerged apples and fruits of *Crataegus*, Fall Creek, Forest Home; Lloyd Reservation; throughout the year.

ANCYLISTALES

49. MYZOCYTIUM PROLIFERUM Schenk, Über das Vorkommen contrakt. Zellen im Pflanzenreich **1858**: 10. In *Mougeotia* sp. and *Spirogyra* sp., Beebe Lake; Dec. 1931.

[2] *Apodachlya punctata* Minden, was found in abundance on twigs of *Fraxinus* at Arlington, Mass., in May, 1932.

PYTHIALES

50. ZOÖPHAGUS INSIDIANS Sommerstorff, Oest. Bot. Zeits. **61**: 361. 1911. Occurring with *Sommerstorffia spinosa.*

51. PYTHIOGETON TRANSVERSUM Minden, Falk, Myc. Untersuch. Ber. **2**: 242. 1916. Saprophytic on twigs of *Fraxinus,* Fall Creek, Forest Home; throughout the year.

What is seemingly a globose variety of this species has been encountered both in the vicinity of Ithaca and in New Hampshire. The mycelium is slender, 2–4 μ in diameter, often markedly thick-walled, and moderately branched. Terminal, or occasionally intercalary, globose sporangia, 35–40 μ in diameter are profusely formed. Occasionally, on the same hyphal complex on which globose sporangia are borne, an isolated bursiform one, entirely similar to that figured by Minden as typical for the species, occurs. These, while varying somewhat in size, and becoming successively smaller with proliferation, are generally about 40 μ long (exclusive of the tube of discharge which is generally about 10 μ in length) and about 10 μ, expanding to 23–25 μ in diameter. Often, the sporangia are intercalary. Sporangial germination was only partially observed, and that in but one instance. When first seen, the long vesicle was rapidly deliquescing, and the slightly irregular protoplasmic mass was becoming more rounded in shape (PLATE 49, FIG. 23). The latter was about five times farther removed from the mouth of the discharge tube than depicted in the drawing. Practically no motion of the protoplasmic mass was evident until the spores had reached a relatively advanced state of maturity (PLATE 49, FIG. 24). They were of the laterally biciliate type, somewhat similar to those of *Pythium,* but more rounded, and were about 18 μ long by 12 μ in diameter. Attempts to cultivate the fungus on artificial media were unsuccessful.

52. PYTHIOMORPHA GONAPODIOIDES Petersen, Bot. Tidsk. **29**: 391. 1909. Common on twigs of *Fraxinus,* Beebe Lake; Fall Creek; throughout the year.

53. PYTHIUM TENUE Gobi, Script. Bot. Hort. Univ. Imp. Petro. **15**: 211. 1899. Parasitic in *Vaucheria sessilis,* Bessemer; March, 1932. The "light and dark" areas noted in the

mycelium by Gobi and Matthews (**3**) are apparently caused by elongate globules of oil with which the hyphae abound.

54. PYTHIUM GRACILE Schenk, sensu lat. Matthews (l. c.). Parasitic in *Spirogyra* spp., Beebe Lake; Fall Creek; August–Dec., 1931.

55. PYTHIUM DICTYOSPORUM Racib. Bull. Int. Acad. Sci. Cracovie **1891**: 283. Parasitic in *Spirogyra* sp., Beebe Lake; Jan., 1932.

FUNGI IMPERFECTI

56. HARPOSPORIUM ANGUILLULAE Lohde. Parasitic on a Nematode, Beebe Lake; March, 1932; associated with *Rhizophidium sphaerocarpum*. As was suggested by Zopf (**10**), this fungus is undoubtedly similar to the supposed chytridiaceous fungus, *Polyrhina multiformis* Sorokin. The conidia are sickle-shaped and are borne on an extramatrical conidiophore (PLATE 49, FIGS. 1, 2). Zopf has published an exhaustive account of the fungus and the present material yielded no further points of interest. The organism has been reported from Canada by Bisby, Buller, and Dearness (**1**).

SUMMARY

This paper concludes the account of the aquatic fungi found by the writer in the vicinity of Cornell University. The total number of aquatic fungi collected was 76, of which 64 are reported in this paper and 12 in a previous one (**8**). All but one of those reported (*Harposporium*, a member of the Imperfecti) were Phycomycetes. Among the latter are included two new genera and ten new species of chytrids and one new variety of *Monoblepharis*.

The writer wishes to thank Mr. F. T. Brooks, F.R.S., for his kindness in reading over the manuscript.

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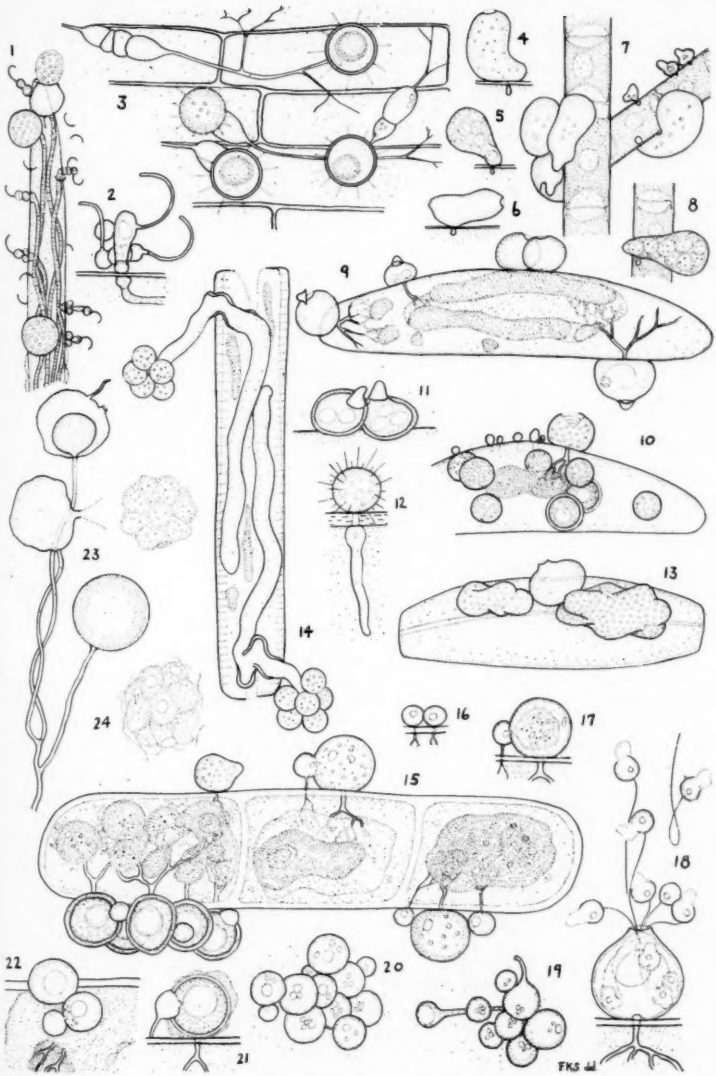

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EXPLANATION OF PLATE 49

All figures were drawn with the aid of the camera-lucida from living material. The approximate magnifications are given in each instance.

Fig. 1, *Rhizophidium sphaerocarpum* and *Harposporium Anguillulae* on a dead Nematode. A discharging sporangium of *Rhizophidium* is shown at the tip of the Nematode, × 260; Fig. 2, Extramatrical conidiophore of *Harposporium* bearing immature conidia, × 600;. Fig. 3, *Cladochytrium replicatum*, spiny resting spores found in grass culm, × 375; Figs. 4–8, *Phlyctidium anatropum*. All × 692, Figs. 4–6, illustrating various shapes of sporangium, Fig. 7, group of sporangia in various stages of development on *Stigeoclonium*, Fig. 8, sporangium with fully formed zoöspores.

Figs. 9–11. *Chytridium perniciosum* Sparrow, on *Navicula;* all × 375, Fig. 9, group of discharged sporangia, Fig. 10, intramatrical resting spores, an immature sporangium with invaginated operculum, and a group of germinating zoöspores. Fig. 11, two abnormal sporangia with large, horn-like opercula.

Fig. 12, chytrid with radiating hairs on sporangium, found on *Cladophora*, × 375; Fig. 13, *Rhizophidium gibbosum*, two undischarged sporangia on *Navicula*; also the discharged sporangium of an undetermined chytrid, × 375; Fig. 14, *Aphanomycopsis bacillariacearum*, two discharged sporangia on *Pinnularia*, × 375; Figs. 15–22, *Rhizophidium* sp., Fig. 15, infected fragment of a filament bearing a group of mature resting spores with companion cells, and copulating thalli, Fig. 16, two young thalli, Fig. 17, copulating thalli, showing fertilization tube, Fig. 18, discharging sporangium, Fig. 19, group of thalli on surface of host showing elongate (fertilization ?) tubes, Fig. 20, typical group of copulating thalli on surface of host cell, Fig. 21, mature resting spore with irregular, brown incrustation on the wall, and an adherent male cell torn from its rhizoidal system, Fig. 22, copulating thalli on surface of host cell showing fertilization tube with unusual clarity, all × 692; Fig. 23. *Pythiogeton transversum*, group of sporangia, one of which has recently discharged its contents. The latter is shown being cleaved into zoöspores. This mass was about five times farther removed from the discharge tube than here depicted, × 260; Fig. 24. *P. transversum*, mass of zoöspores nearly mature, × 260.

TWO APPLE BLACK ROT FUNGI IN THE UNITED STATES

NEIL E. STEVENS

(WITH 1 TEXT FIGURE)

In their studies of the black rot of apple and its causal organism, various investigators have discussed without reaching any real agreement, one or both of two apparently somewhat unrelated points; whether the fungus designated by Peck as *Sphaeropsis malorum* is identical with that to which Berkeley gave the same name, and whether the black rot of the eastern United States is also present in the apple-growing States of the Northwest. In the course of work on this group of fungi, it has become apparent that the two questions are interdependent—at least to the extent that confusion on the first point has apparently contributed to lack of agreement on the second. It is, therefore, proposed to discuss the available evidence, which has led to the present conclusion that Berkeley's fungus and the "*Sphaeropsis*" most frequently found on apple and pear in Oregon are identical but that this species is not the one studied and described by Peck and which is common in the Eastern United States on apple and many other hosts. Since the writer's opinion is at variance with that held by several experienced investigators, the evidence will be presented in some detail.

THE TYPE SPECIMENS

BERKELEY'S TYPE. In 1836 Berkeley (**1**) discovered a fungus fruiting on a decayed apple and described it under the name of *Sphaeria malorum*. In 1860 (**2**) he changed the name to *Sphaeropsis malorum*. The type specimen is now in the Berkeley Herbarium at Kew, England, and from this, through the courtesy of the Director, we have been furnished several excellent slides.

PECK'S TYPE. Attention has several times been called to the fact that Peck at first considered the fungus which he found causing a black rot of apples in New York State as identical with

Berkeley's, and in his publications, 1878 (**5**) and 1881 (**6**), used the name *Sphaeropsis malorum* Berk. In 1884, Saccardo (**8**) transferred Berkeley's fungus to the genus *Phoma* as it was described as having hyaline spores, and made the combination *Phoma malorum* (Berk.) Sacc. Since Peck's fungus had brown spores Saccardo considered it not the same as Berkeley's and used for it the name *Sphaeropsis malorum* Peck, which designation was apparently adopted by Peck himself as several of his specimens are so labeled.

This circumstance aids in determining which of Peck's specimens of *S. malorum* is to be considered his type. Peck rarely indicated the year in which specimens were collected. Since, however, only one bears the label *S. malorum* Berk., this is probably the oldest, and must be considered his type. Dr. House, the present Curator of the New York State Herbarium, states that the probability of this being the oldest of Peck's specimens is further confirmed by the fact that the label is on thin blue paper of the kind earliest used by Peck. This specimen consists of a small mummified apple, covered with pycnidia.

STROMATIC CHARACTERS

The two fungi are certainly very similar in stromatic characters and in the structure of the pycnidia, which for Peck's fungus have been well described and illustrated by Hesler (**4**).

Continued study of this group has, however, convinced the writer that stromatic characters are so variable in these fungi as to be worthless for diagnostic purposes. The size of the stroma and the number of and the complexity of the spore chambers varies with the substratum. Subcultures from a single spore culture grown on twigs with such different bark structures as raspberry and currant look quite different in size and general appearance and both differ from those grown in pure culture on corn meal. The pycnidia on the smooth, thin bark of the raspberry are small and unilocular, while those on currant are thicker walled and multilocular, and those on corn meal have thick loosely woven walls. The amount of hirsuteness is markedly influenced by humidity—pycnidia produced on twigs in culture flasks which give a variable

humidity show a regular gradation being much more hairy where humidity is high and smooth surfaced where the humidity is low.

Attention has, of course, been frequently called to the extreme variability of the stroma in this group of fungi. More than fifty years ago Ellis (**3**) discussed the same point with reference to what he then called *Sphaeria quercuum* Schw. Ellis pointed out that the variation in the size and structure of the stromata is not accompanied by a corresponding variation in the "fruit," and he refuses to consider stromatic variation alone as a specific difference, and uses the following figure:

"With just as much reason might a specific distinction be made between the cluster of culms sprung from a single grain of wheat planted in a good soil and the single culm from another grain growing in a poorer soil."

SPORE CHARACTERS

The only constant difference between these two fungi which the writer has thus far discovered is in the spore characters. The spores in Berkeley's fungus are rather regular in form measuring 9–13 × 22–33 μ, mostly 9.5–10 × 23–29 μ. Most of them are hyaline, nonseptate, with a relatively thick wall which appears glassy under the microscope. This wall is very characteristic and is similar to that seen in hyaline pycnospores of the tropical and southern fungus known under a variety of names, including *Diplodia natalensis* and *D. cacaoicola*.

Slide No. *3215* from Berkeley's type contains in addition to numerous hyaline, nonseptate spores, a few light tan nonseptate spores measuring 15 × 27–30 μ, and one light tan one septate spore—12 × 30 μ. Slide No. *3216* also contains one tan septate spore—12 × 24 μ.

The spores of Peck's fungus, however, differ from those of Berkeley's being uniformly tan to brown in color and many of them being rather irregular in shape. Some of these spores are septate but there is no constant difference in color between septate and nonseptate spores. The spores of Peck's type specimen measure 12–18 × 24–30 μ, mostly 12–13 × 25–27 μ.

The chief difference between the two fungi is in the shape, size, and particularly the color or rather the time of coloring of the

pycnospores. Those of Berkeley's fungus are somewhat more regular in shape, longer in proportion to their width and judging from the number of hyaline spores, remain hyaline for a considerable length of time before becoming brown and septate. The pycnospores of the fungus described by Peck, on the other hand, almost invariably become colored while still in the pycnidium, as illustrated in Peck's figure.

Whether such differences can safely be regarded as specific depends in a large part on whether they are constant. On this point, the behavior of what appear to be the same fungi in cultures made from recent collections should throw some light. Berkeley's fungus is represented among others by our culture No. *1286* on cut apple branch from Torquay, England. These cultures show the characteristics to be expected from the appearance of the slides made from the host, that is, the spores remain hyaline for a relatively long period and in general become colored after they are extruded from the pycnidium. Peck's fungus is represented by cultures from numerous hosts, including apple, in Eastern United States. In all of these the pycnospores are regularly colored before extrusion. In view of the apparent constancy of their spore characters the writer is inclined to consider these two fungi at least specifically distinct. It may be noted, without attempting to review the synonymy at this time, that Petrak and Sydow (**7**) find this difference in time of coloring so constant that they consider it the most reliable character for distinguishing the separate genera in which they place the two fungi here under consideration.

HOST RELATIONS

It is the unanimous opinion of those writers who have studied the apple black rot fungus in the field that it grows readily as a saprophyte on a very large number of host species. While parasitism is apparently rather limited even on the apple, the fungus is found more commonly on plant parts which have been cut or broken by the wind or have suddenly been killed by lightning, fire, or disease. Where fungi of this type are common they generally appear on cut trees or branches, often to the exclusion of other fungi. Incidentally it is obvious that such favorable

substrata must have become much more abundant in this country since the advent of the white man.

The following list of host genera on which this species has been found will serve as a concrete example of its omnivorous nature.

Acer
Aesculus
Ailanthus
Amorpha
Amygdalus
Aristolochia
Artemisia
Benzoin
Carissa
Cassandra
Castanea
Ceanothus
Celastrus
Celtis
Cercis
Citrus
Cladonia
Clematis
Convolvulus
Cornus
Corylus
Crataegus
Cydonia
Diospyros
Elaeagnus
Euonymus
Ficus
Fraxinus
Gleditsia
Hibiscus
Hicoria
Ilex
Juglans
Juniperus
Larix
Lonicera
Maclura
Magnolia
Malus
Melia
Morus
Negundo
Onagra
Opulaster
Opuntia
Ostrya
Phleum
Pinus
Platanus
Populus
Prunus
Psedera
Pueraria
Pyrus
Quercus
Rhus
Ribes
Ricinus
Robinia
Rosa
Rubus
Salix
Sambucus
Sassafras
Smilax
Taxus
Tilia
Ulmus
Viburnum
Vinca
Vitis
Wisteria
Zea

DISTRIBUTION OF THESE TWO FUNGI IN THE UNITED STATES

In this paper the common apple black rot fungus described by Peck is designated as *Physalospora obtusa* (Schw.) Cooke, and Berkeley's fungus as *Diplodia mutila* Fries. The reason for this choice of names will be presented in detail in a later section. For the purpose of discussing the distribution of these fungi, it is of no importance whether one considers them as varieties of a single species, as separate species of a genus, or as belonging to separate genera. In any case, the available information regarding their distribution indicates that the apple black rot fungus is very common in the eastern part of the United States and has not yet been found in the northwestern section. It is, however, found in southern Europe. On the other hand, the apple fungus of the Pacific

Coast is very rare in the eastern United States but relatively common in western Europe. The map, figure 1, gives the known distribution of these two fungi in the United States as represented by material now in the Mycological Collections of the Bureau of Plant Industry, including a large number of specimens collected during the last twenty years by Dr. C. L. Shear and the writer. Dots mark those localities in which pycnidial material of *P. obtusa* (Schw.) Cooke has been found, and circles mark the localities in

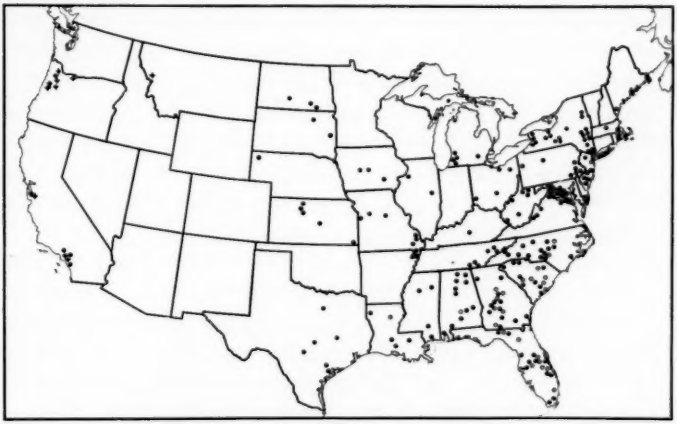

FIG. 1. Distribution in the United States of the two fungi discussed in this paper as indicated by specimens in the Mycological Collections of the Bureau of Plant Industry.

Circles = Ascospore material of *Physalospora obtusa* (Schw.) Cooke.
Dots = Pycnospore material of *P. obtusa*.
\+ = *Diplodia mutila* Fries.

which ascospore material of this species has been found. There are thus indicated here only ascospore specimens from which cultures have been made and typical pycnidia produced in the cultures.

These two symbols thus show the known distribution of this species in the continental United States, namely, a few collections in southwestern California, and a wide distribution east of the Rocky Mountains. It is much more abundant in the well wooded states east of the Mississippi Valley, the predominance in this region being much greater than the map indicates. It is impos-

sible to show on so small a scale all the collections in States where much work has been done, as for example, in the vicinity of Albany, New York; Newfield, New Jersey; Washington, D. C., etc.

Mature ascospore material of *P. obtusa* is much more abundant in the southeastern than in the northeastern States, in this region the number of specimens which might be obtained is practically limited only by the time available for collecting.

So far as our collections indicate *Diplodia mutila* is confined in the United States to the far west. The most easterly point so far reported is Missoula, Montana, where two specimens were gathered by Weir. Four collections are known from California. These are from two localities near the Coast in regions of intensive cultivation. The fungus has been collected a number of times in western Oregon. As already noted this fungus is also fairly common in western Europe. Students of plant distribution have long recognized the close similarity of western Europe and the northwestern United States.

PHYSALOSPORA OBTUSA

Recent statements regarding the names of the apple black rot fungus have usually been rather guarded. Hesler (**4**) in announcing his discovery of the perfect stage of the fungus tentatively referred it to *Physalospora Cydoniae,* and added (p. 100), "The question of the specific name is still unsettled, for it is not improbable, as stated above, that the organism has been previously described under some other specific name."

The suggestion of Shear, Stevens and Wilcox (**9**) (p. 100) is as follows, "The writers are now inclined to believe that the safest citation for the pycnidial stage of the organism in question is *Sphaeropsis malorum* (Peck), and for the ascogenous stage, *Physalospora malorum* (Peck)." These writers apparently had in mind conserving the name *S. malorum* which is strongly entrenched in American usage. In view, however, of the fact that the specific name "malorum" had previously been applied to another fungus by Berkeley it is perhaps wiser to abandon it in favor of an older name.

The oldest names applied to this fungus which the writer has thus far found are those given by Schweinitz. Careful study of

his type material both in the Schweinitz Herbarium at Philadelphia and the Michener Herbarium now in the United States Department of Agriculture shows at least ten with Schweinitzian names to be synonyms of *S. malorum* of Peck. Only one of these specimens, namely, *Sphaeria obtusa,* shows ascospores.

The presence of ascospores in the portion of this type specimen in Ravenel's Herbarium in the British Museum was noted by Cooke who made the combination, *Physalospora obtusa.*

P. obtusa (Schw.) Cooke is represented in our collection by specimens from the Michener Herbarium, and by a slide from a specimen in the original packet of Schweinitz in the Philadelphia Academy of Natural Sciences. The specimens in both the Michener and Schweinitz Herbaria are in excellent condition and both show a number of mature pycnospores 9–13 × 19–28 μ, mostly 12 × 24–28 μ in size, uniformly tan in color, and many of them septate.

In stromatic and pycnospore characters this material is almost an exact duplicate of Peck's type of *Sphaeropsis malorum.* One of the specimens also contains stromata with numerous mature, hyaline ascospores 10–12 × 26–32 μ. While it is, of course, impossible to prove the connection of the two spore forms they are closely associated, and the relation of similar spore forms has been frequently demonstrated in cultures, so there is no reason to doubt that the material Cooke examined in Berkeley's Herbarium and transferred to the genus *Physalospora* was of this species. Schweinitz' name *S. obtusa* was published in 1832 and Cooke's *P. obtusa* in 1892. There seems then to be good reason to designate this fungus as *P. obtusa* (Schw.) Cooke.

PHYSALOSPORA OBTUSA (Schw.) Cooke, Grevillea **20**: 86. 1892.

A complete synonymy of a fungus so widely distributed, on such a variety of hosts, and so easily collected and preserved will not soon be prepared. The present list must be regarded as merely preliminary. Synonyms based on examination of type or authentic material of perithecial as well as pycnidial stages.

Sphaeria obtusa Schw. Trans. Am. Phil. Soc. II. **4**: 220. 1832.
Melanops quercum (Schw.) Rehm forma *Vitis* Sacc. Sec. Shear, Science **31**: 748. 1910.

Physalospora Cydoniae Arnaud, Sec. Hesler, Bull. Cornell Univ. Agri. Exp. Sta. **379**: 101. 1916.

Physalospora malorum (Peck) Shear, Mycologia **17**: 100. 1925.

Synonyms based on examination of type or authentic material of pycnidial stage only.

Sphaeria Gleditseae Schw. Trans. Am. Phil. Soc. II. **4**: 40. 1832.

Sphaeria junipericola Schw. Trans. Am. Phil. Soc. II. **4**: 205. 1832.

Sphaeria subfasciculata Schw. Trans. Am. Phil. Soc. II. **4**: 214. 1832.

Sphaeria pericarpii Schw. Trans. Am. Phil. Soc. II. **4**: 215. 1832.

Sphaeria ampelos Schw. Trans. Am. Phil. Soc. II. **4**: 217. 1832.

Sphaeria albo-farcta Schw. Trans. Am. Phil. Soc. II. **4**: 218. 1832.

Sphaeria rhuina Schw. Trans. Am. Phil. Soc. II. **4**: 218. 1832.

Sphaeria Lonicerae Sow. Trans. Am. Phil. Soc. II. **4**: 219. 1832.

Sphaeria pyrina Fries, Sec. Schw. Trans. Am. Phil. Soc. II. **4**: 219. 1832.

Sphaeria druparum Schw. Trans. Am. Phil. Soc. II. **4**: 219. 1832.

Sphaeria saepincola Fries, Sec. Schw. Trans. Am. Phil. Soc. II. **4**: 220. 1832.

Sphaeria meloplaca Schw. Trans. Am. Phil. Soc. II. **4**: 223. 1832.

Diplodia seriata De-Not, Micr. Ital. Dec. IV, n. 6. 1837.

Sphaeropsis Platani Peck, Ann. Rep. N. Y. State Mus. **25**: 85. 1873.

Sphaeropsis fusiger Berk. & Curt. Grevillea **2**: 181. 1874.

Sphaeropsis tephrospora Berk. & Curt. Grevillea **2**: 180. 1874.

Sphaeropsis pennsylvanica Berk. & Curt. Grevillea **2**: 180. 1874.

Sphaeropsis Sumachi Cooke & Ellis, Grevillea **5**: 31. 1876.

Sphaeropsis ribicola Cooke & Ellis, Grevillea **5**: 55, *pl. 80.* 1876.

Sphaeropsis fibriseda Cooke & Ellis, Grevillea **5**: 89. 1877.
Sphaeropsis Punctum Cooke & Ellis, Grevillea **6**: 2, *pl. 96*. 1877.
Sphaeropsis rosarum Cooke & Ellis, Grevillea **6**: 2. 1877.
Sphaeropsis rubicola Cooke & Ellis, Grevillea **6**: 2–3, *pl. 95*. 1877.
Sphaeropsis clethraecola Cooke & Ellis, Grevillea **6**: 84. 1878.
Sphaeropsis Cydoniae Cooke & Ellis, Grevillea **6**: 84. 1878.
Diplodia decorticata Cooke & Ellis, Grevillea **6**: 85. 1878.
Sphaeropsis Maclurae Cooke, Grevillea **6**: 134. 1878.
Sphaeropsis opaca Cooke & Ellis, Grevillea **7**: 5. 1878.
Melogramma fuliginosa (Moug. & Nest.) Ellis, Proc. Acad. Phila. **1879**: 70. 1879.
Sphaeropsis abundans Peck, Ann. Rep. N. Y. State Mus. **33**: 24. 1880.
Sphaeropsis cerasina Peck, Ann. Rep. State Mus. **33**: 24. 1880.
Sphaeropsis phomatella Peck, Ann. Rep. N. Y. State Mus. **33**: 24. 1880.
Sphaeropsis seriatus Peck, Ann. Rep. N. Y. State Mus. **33**: 24. 1880.
Sphaeropsis malorum Peck, Ann. Rep. N. Y. State Mus. **34**: 36. 1881.
Diplodia pinea Kx. var. *corticola* Peck, Ann. Rep. N. Y. State Mus. **38**: 98. 1885.
Sphaeropsis tiliacea Peck, Ann. Rep. N. Y. State Mus. **39**: 45. 1886.
Diplodia caryigena Ellis & Ev. Proc. Acad. Phila. **1894**: 363. 1895.
Sphaeropsis Physocarpi Ellis & Ev. Proc. Acad. Phila. **1894**: 361–362. 1895.
Sphaeropsis Oenotherae Ellis & Ev. Field Columb. Mus. **9**: 114. 1896.
Sphaeropsis Robiniae Ellis & Barth. Erythea **4**: 81. 1896.
Sphaeropsis triacanthi Ellis & Barth. Erythea **4**: 81. 1896.
Sphaeropsis Ailanthi Ellis & Barth. Erythea **5**: 48. 1897.
Sphaeropsis Phlei Ellis & Ev. Am. Nat. **31**: 429. 1897.
Sphaeropsis Populi Ellis & Barth. Erythea **5**: 49. 1897.
Sphaeropsis ulmea Ellis & Barth. Erythea **5**: 49. 1897.
Sphaeropsis fertilis Peck, Bull. Torrey Club **25**: 327. 1898.

Sphaeropsis Juglandis Ellis & Barth. Trans. Kans. Acad. Sci. **16**: 166. 1899.

Sphaeropsis Persicae Ellis & Barth. Jour. Myc. **8**: 175. 1902.

Sphaeropsis Magnoliae Ellis & Dearn. Fungi Columb. no. *2087*. 1905.

Sphaeropsis Ceanothi Dearn. & House, Bull. N. Y. State Mus. **188**: 40. 1916.

Sphaeropsis parallela Dearn. & House, Bull. N. Y. State Mus. **188**: 40. 1916.

Sphaeropsis Viburni-dentati Dearn. & House, Bull. N. Y. State Mus. **188**: 41. 1916.

Diplodia Convolvuli Dearn. & House, Bull. N. Y. State Mus. **197**: 28. 1917.

Sphaeropsis Aristolochiae Dearn. & House, Bull. N. Y. State Mus. **197**: 43. 1917.

Sphaeropsis punctata Dearn. & House, Bull. N. Y. State Mus. **197**: 36. 1917.

Sphaeropsis Negundinis Tehon & Daniels, Mycologia **17**: 242–243. 1925.

Sphaeropsis Clematidis Dearn. & House (*Macroplodia Clematidis* Dearn. & House), N. Y. State Mus. Bull. **266**: 85. 1925.

Unpublished Names

Sphaeria pomarum Berk. & Curt. (In herb.)

Sphaeropsis pomorum Berk. & Curt. (In herb.)

Sphaeropsis pulvinacea Berk. & Curt. (In herb.)

Sphaeropsis semitecta Berk. & Curt. (In herb.)

Sphaeropsis subcuticularis Dearn. & House. (In herb.)

DIPLODIA MUTILA

In suggesting *Diplodia mutila* Fries as the name for the fungus described by Berkeley as *Sphaeropsis malorum*, it is not intended to raise the question as to whether both *Sphaeropsis* and *Diplodia* can be retained as valid genera. The intention here is merely to indicate the earliest known name for the fungus under discussion. It should be remembered that only the pycnidial stage of this fungus is known and until the perithecial stage is demonstrated by actual connection in pure culture further discussion as to its relationship to *P. obtusa* is futile.

Sphaeria mutila was described by Fries in 1823. Two numbers of this species distributed by Fries in his Scler. Suec. *164* and *385*, show no spores in the set now in the Mycological Collections of the Bureau of Plant Industry.

In 1834, Montagne submitted to Fries a specimen of a fungus from *Populus* sp. which Fries determined as identical with *Sphaeria mutila*, and on the basis of which he established a new genus *Diplodia*, the first description of which was published by Montagne in 1834 as follows:

No. 27. *S. mutila* Fries, l. c. p. 424. PLATE 13, FIG. 7. Exs. Desmaz. Crypt. n. *619*.—Nobis, n. *498*.

Cette espèce devenue le type du nouveau genre *Diplodia*, ainsi caractérisé par M. Fries: Asci elliptico-oblongi, didymi, sporidiis binis referti.—Sur le tronc d'un Peuplier mort, dans le parc de M. Lamotte, à Sedan.

Examination of several good slides of Montagne's No. *498*, taken directly from an autograph specimen in the herbarium at Strasburg, shows only pycnidia with the structure typical of this group and with spores 10–16 × 20–27, mostly 10–12 × 25–27 μ. Both hyaline one-celled and tan one-septate spores are present, the hyaline spores having the characteristic glassy walls mentioned in discussing the type of Berkeley's specimen.

A careful comparison of these two specimens leads to the conclusion that the species are identical and that Berkeley's name should give way to the much older—*D. mutila*. The only possible basis for separation is that of host, which was long ago discredited by those who have studied this fungus in the field.

DIPLODIA MUTILA (Fries) Mont. Ann. Sci. Nat. II. **1**: 302. 1834.

Sphaeria mutila Fries, Syst. Myc. **2**: 424–425. 1823.
Sphaeria Amorphae Wallr. Flora Crypt. Ger. **2**: 781. 1833.
Sphaeria malorum Berk. Eng. Fl. **5**: 257, Part II. 1836.
Diplodia Aesculi Lév. Ann. Sci. Nat. III. **5**: 290. 1846.
Diplodia melaena Lév. Ann. Sci. Nat. III. **5**: 292. 1846.
Sphaeropsis sociata Lév. Ann. Sci. Nat. III. **5**: 295. 1846.
Sphaeropsis cylindrospora Desm. Ann. Sci. Nat. III. **11**: 277. 1849.

Sphaeropsis malorum Berk. Outlines Brit. Fung. 316. 1860.
Diplodia quercina West. Bull. Acad. Belg. II. **2**: 560, No. 7. 1857.
Diplodia Quercus Fuckel, Symb. Myc. 170. 1869.
Diplodia samararum Sacc. Mycoth. Ven. Cent. 14, n. *1396*. 1879.
Diplodia rhuina Cooke & Hark. Grevillea **9**: 6, Sept. 1880.
Diplodia cynanchina Petrak, Ann. Myc. **20**: 13. 1922.

Unpublished Names

Diplodia Acubae West. (In herb.)
Diplodia Marsdeniae Thüm. (In herb.)
Sphaeropsis Diospyri Berk. & Br. In herb. not the *S. Diospyri* of Dearn. & Barth.

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NOTES AND BRIEF ARTICLES

A general index to the seven volumes of the Mycological Writings of the late Curtis G. Lloyd of Cincinnati, Ohio, has been prepared and published by the Lloyd Library and Museum. Copies may be secured by those possessing sets of Mr. Lloyd's writings upon application to the Librarian at Cincinnati or to John A. Stevenson, Custodian, C. G. Lloyd Mycological Collections, Smithsonian Institution, Washington, D. C.

Endothia Parasitica in Washington

Chestnut blight or better perhaps "Chestnut Canker" which has interested plant pathologists in eastern United States for over a quarter of a century was discovered in Seattle on American Chestnut (*Castanea dentata*) during the summer of 1932. Specimens were sent to Dr. F. D. Heald of the State College at Pullman, Washington, and also to Dr. C. L. Shear of the Bureau of Plant Industry, Washington, D. C., both of whom confirmed the determination.

Scouting and inquiry in the immediate vicinity of Seattle revealed one infected tree at Laurelhurst, a suburb, and four on the University Campus all about the same age, five to eight years old. It was further learned that all these trees were grown in the same nursery from seed sent from New York State from what was believed to be a non-infected region. An examination of the infected trees showed that in all cases the original infections were at or near the ground and only one case could be found where there appeared to be a secondary infection on an upper branch. Careful search has failed to find older Chestnut trees infected although some were growing within twenty or thirty feet of the infected ones. During the past summer scouting was carried on in the vicinity of Seattle but no additional infections were discovered. A circular letter was also addressed to many of the nurserymen in Western Washington but without obtaining any additional facts.

This is the first record of this disease in the State of Washington. A few infected trees, however, were reported at the Experimental Farm at Agassiz, B. C. about 1914, and at Gunter, Oregon, in 1929. In both these regions the disease has apparently been eradicated.

The information at hand seems to indicate that this outbreak of Chestnut blight at Seattle has come from imported infected seed. It is hard, however, to conceive of this organism taking five to eight years to kill Chestnut seedlings unless in the Pacific Northwest it behaves differently from what it does in eastern United States. There are some indications that this may be true.

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MYCOLOGICAL SOCIETY OF AMERICA

SUMMER FORAY

At the invitation of the Director and Trustees of the Highlands Museum and Biological Laboratory, the first summer foray of the Mycological Society of America was held at Highlands, North Carolina. Situated at an altitude of nearly four thousand feet in the Blue Ridge of southwestern North Carolina, not far from the borders of Georgia and South Carolina, in a region of dense forests and abundant moisture, Highlands represents an ideal location for mycological collecting. A wide range of habitats is available within easy walking distance and short automobile trips afford an infinite variety of natural conditions, together with unexcelled mountain scenery.

The morning of August 17 was spent in a second growth white pine plantation near at hand. Agarics and clavarias were abundant. A gentle rain dampened the clothing but not the enthusiasm of the group and after lunch in town the sun came out, promising good weather for the trip up Black Rock Mountain in the afternoon. Later, the weather became threatening and there were occasional light showers, but good collecting was experienced on the way up and an impressive view of mountain scenery enjoyed from the summit. It started to rain in earnest before we started down, and everyone was thoroughly soaked on the trip back. However,

we reached shelter without serious harm and those who had been sufficiently foresighted changed to dry clothing. The evening was spent at the laboratory caring for collections and in informal discussion.

The following days were fortunately clear. On Friday morning a walk of five miles took us past the beautiful Highlands Falls and through the primeval forest of the Ravenel tract, a nearly pure stand of giant hemlocks, interspersed with enormous cherries

From left to right: J. H. Miller, A. F. Grassmyer (kneeling), L. R. Hesler, W. W. Diehl, L. O. Overholts, Nell Henry, C. L. Shear, Caroline A. Lander, G. W. Martin, Alma Holland, Edith K. Cash, Vera K. Charles, J. P. Porter, T. G. Harbison.

and with an undergrowth of dense laurel thicket, the floor being an accumulation of humus such as few of us had seen. As might be expected, collecting was rich in the extreme, and most of the afternoon was spent in studying and drying the collections of the morning, with a few informal trips by those who felt they could spare the time. In the evening the group was entertained by Professor Coker at his summer home, in delightfully informal fashion.

Saturday morning a short business session was held, with President Shear in the chair. The following resolution was adopted:

The members of the Mycological Society of America attending the Highlands Foray wish to extend to the Director and Trustees of the Highlands Museum and Biological Laboratory their appreciation of the privileges accorded them, and to the members of the local committee their thanks for arranging for accommodations and planning the excursions in such a way as to insure a successful and enjoyable meeting.

The desirability of publishing records of collections at the foray was discussed. It was the sense of the meeting that each individual submit as complete a list as possible of the species collected to Dr. Hesler, with the thought that these be incorporated in a general list of the fungi of the region to be issued by the Highlands Museum and Biological Laboratory. It was further voted that each individual note new or noteworthy species occurring on his list and that Dr. Hesler collate and edit a list of such species for publication in Mycologia at an early date.

Following adjournment, the rest of the morning was spent in caring for collections and in short informal excursions. In the afternoon most of the party went by automobile to the upper falls of the Whitewater River, near the South Carolina border, in a deep, densely forested interior valley entirely surrounded by high mountains. Time did not permit extensive collecting but an unusual opportunity was afforded to visit a section of the mountains rarely seen by outsiders.

While the attendance was small, those who were there were unanimous in feeling that the meeting was well worth while, both in the opportunities afforded for collecting in a region of great botanical and mycological interest and for the chance afforded to make or renew personal acquaintance under the most favorable circumstances. Incidentally, thanks to the arrangements made by the local committee, consisting of Dr. Coker, Dr. Reinke and Dr. Hesler, excellent accommodations were provided at very moderate cost.

It is to be hoped that mycologists in increasing numbers will avail themselves of the facilities afforded by the laboratory to study fungi in this fascinating region.

GEORGE W. MARTIN,
VICE-PRESIDENT

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